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Electron Spin Resonance

VIGNETTE

THOMAS M. TRAINER

The field of product development is no longer—if it ever was—simply a system of routine procedures for evolving new, and modifying existing, products, according to Battelle's Thomas M. Trainer. "As we all know, our technologists are achieving breakthroughs in many fields. The field of product development," he points out, "is one of the bridges carrying these revolutionary accomplishments to their potential uses." It is a bridge whose approaches include, in his view, the solution of fundamental technical problems, cross fertilization of ideas from varied disciplines, and truly creative planning and design. This combination, he believes, adds new dimensions to the field, and enhances its contributions to the stature of science and engineering. A strong measure of satisfaction to those in the field is the knowledge that, through feedback to other technological fields, further significant research is stimulated.

Tom has participated in varied studies in the field of product development. Among significant ones may be listed development of (1) an improved cloth-cutting machine, (2) a hydraulic servocylinder for use at elevated temperatures in planes, (3) an improved sewing machine, (4) a versatile tap-changing mechanism for electric transformers, (5) a high-temperature film-type potentiometer, and (6) a design for a disk-type automotive brake.

Other unusual investigations engaging Tom's attention have included development of an experimental heart pump, design of a control device for intravenous feeding, a reliability study of turbo-prop propellor-control systems, and development of a unique vehicle for use in control of vehicular tunnel traffic. Over a period of several years, Tom has also been responsible for an extended survey of mechanical equipment for aircraft.

Tom is an engineer who recognizes the importance of human relations. This has led him to studies of programs for advancing the capabilities of research workers and for evaluating their personal accomplishments. He also gives much attention to improved techniques for measuring progress on research projects.

He is a graduate of Haverford College and a member of the Society of Automotive Engineers. Though Tom plays golf and has been an avid bowler for a number of years, most of his time is reserved now for his two small daughters. For social relaxation, he and his wife, Betty, play bridge occasionally.

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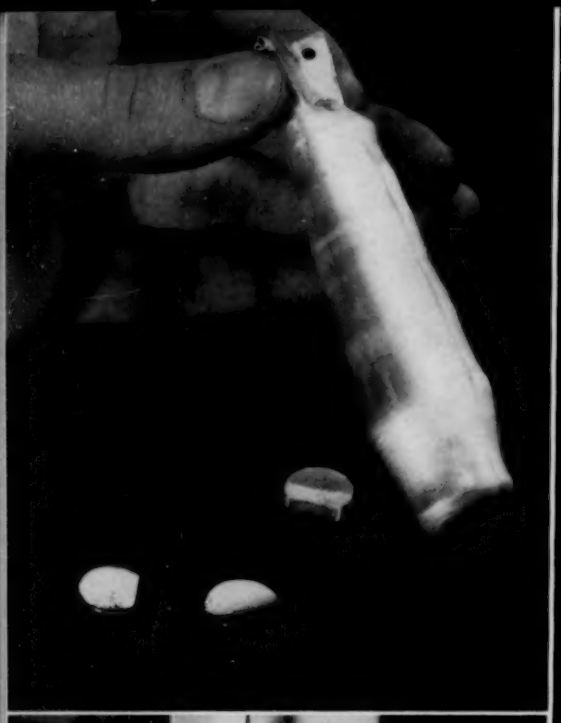
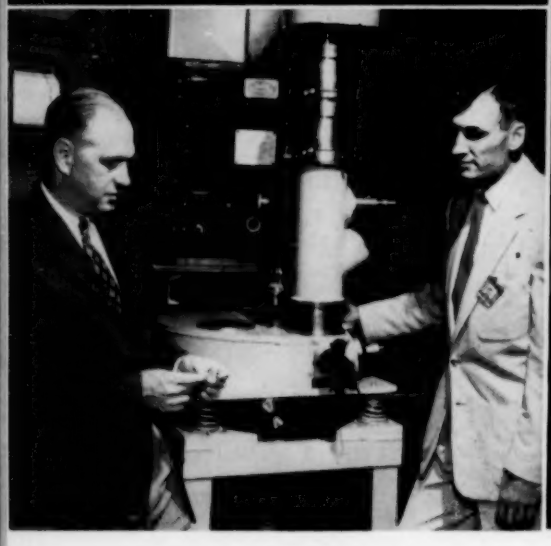
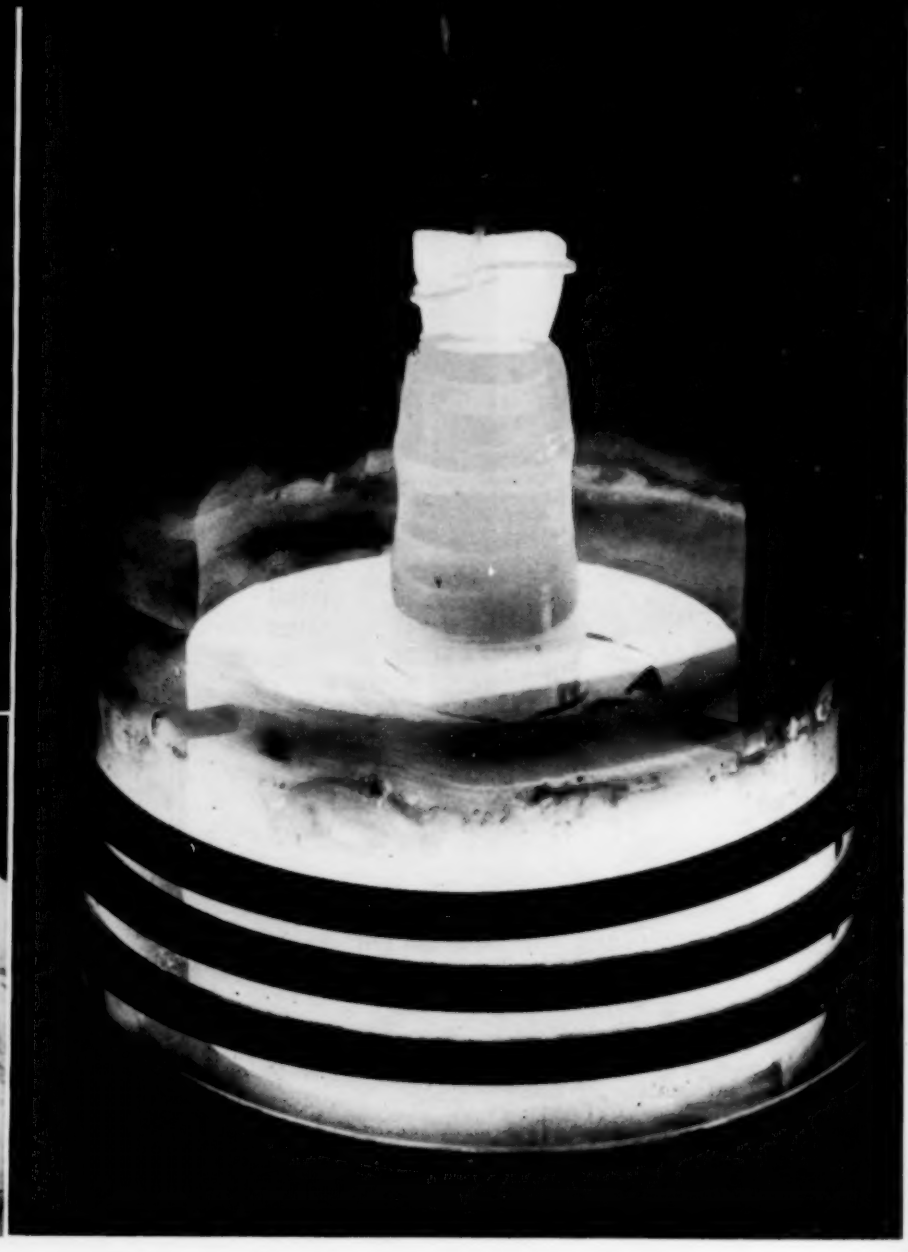






TOWARD NEW LIGHT ON THE INTERDIFFUSION OF METALS

Knowledge of the interdiffusion of metals aids in the understanding of their fundamental properties. Research supported by the Aeronautical Research Laboratory, Wright Air Development Center, is contributing to that knowledge.

The study calls for special oriented copper bicrystals, whose preparation is an art in itself (right). Such crystals give precise control of grain-boundary orientation. The bicrystals are sectioned and the sections polished and plated with nickel (top, left) to provide specimens with a proper interface. The plated specimens are then heated for varying times and temperatures to bring about different degrees of diffusion.

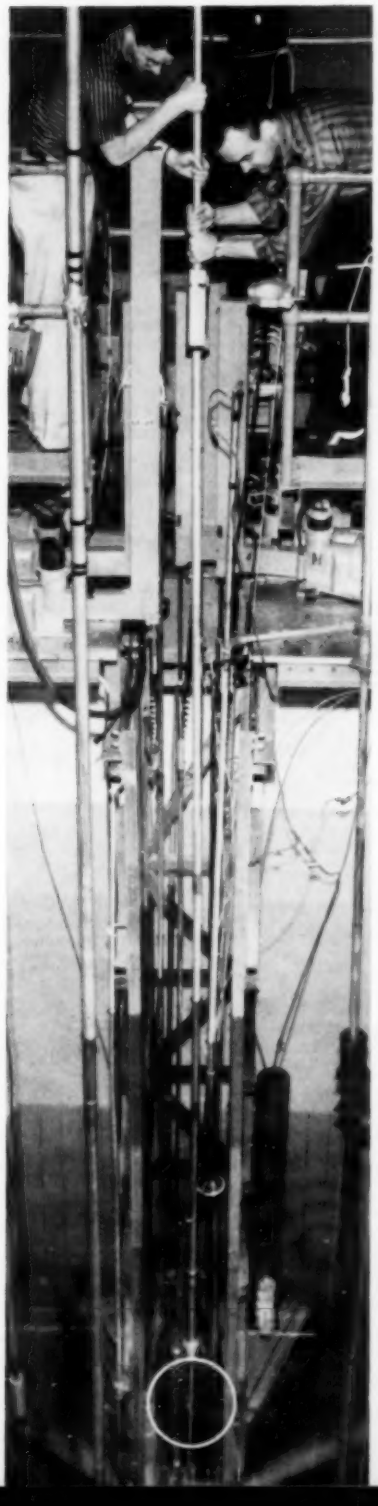
The relative diffusion in the grain boundaries and across the grain of the specimens is determined by examination in the electron probe microanalyzer. A fine beam of electrons, directed at the specimen, causes the emission of X-rays. These identify the elements struck by the beam and closely measure the amounts in its focus.

Examining a specimen to be mounted in the microanalyzer is Charles M. Schwartz (bottom, left) who is responsible for the study being conducted by Battelle's structural chemistry division. Looking on is Harvey Goering, who guided colleagues in the physical chemistry division in preparing the bicrystals.

Irradiation-capsule design appears simple, but the many requirements to be satisfied call for the highest skill and scientific knowledge. The authors describe what is included in . . .

The Art and Science of Encapsulation

by JOHN H. STANG *and* EUGENE M. SIMONS



The coming of nuclear energy has added a new dimension to research in many fields. Once the means were available to supply radiation in massive doses, the demand for work space in research reactors grew rapidly. At the same time, the problems of radiation study were recognized as a challenge to the skill and knowledge of nuclear technologists.

When materials are exposed to nuclear radiations, the effect is often deleterious, and, hence is generally termed "radiation damage". If the radiations are intense, as in a reactor core where there are fast and slow neutrons, penetrating gamma rays, and extremely energetic short-ranged fission fragments, peculiar things happen. In general, chemical reactions are "activated", compounds tend to dissociate, and atoms are knocked out of their crystal-lattice positions by such radiations. Many organic solids disintegrate rapidly, while organic liquids generally increase in viscosity as a result of radiation-induced polymerization. Water is dissociated not only into its elements but also into various free radicals that may increase the corrosion rate of materials in a water-cooled reactor. In the case of metals, the practical effects of prolonged irradiation are usually undesirable changes in such properties as ductility and thermal conductivity. Solids containing fissionable material can, in addition, suffer significant dimensional changes.

The most effective way to learn what reactor radiations will do to a material is to expose samples of it in a reactor under simulated service conditions, and subsequently examine the specimens in a "hot laboratory". Since the bulk of the interest today is in materials for high-temperature power-producing reactors, many experiments demand that the specimens be

Lowering a capsule into its pre-assigned irradiation position in a pool-type reactor. The capsule (circled) is at the end of the lead tube through which its electrical and other connections are passed. The capsule's position in the reactor determines the intensity of radiation, which has been taken into account in the capsule's design.

maintained at elevated temperatures during their irradiation. Also, because radiation damage is generally proportional to the total amount of radiation received (product of flux and time), a high flux level is needed to keep the irradiation time down and still achieve a practical cumulative dosage. Fortunately, there are a number of reactors built specifically for high-flux-level experiments. However, these are all water-cooled pool- or tank-type reactors which operate at low temperatures. Thus, to irradiate a specimen at high temperature in such a reactor, it must be isolated from direct contact with the water and means must be provided to maintain the specimen temperature at the desired value.

Use of Capsules in Irradiation

A common method of isolation is to seal the specimen inside a capsule and irradiate the whole assembly. Nonfuel materials may be heated during irradiation by externally controlled auxiliary resistance heaters inside the capsule. The principal source of heat for fuel-bearing specimens is nuclear fission. In both cases, attenuation of gamma rays by the capsule and specimen materials provides a small amount of additional heat. The capsule body, in effect, serves as an insulating shroud for the specimen. Equally important, in the majority of cases, is its function of containing the radioactive by-products of the irradiation, thus preventing them from escaping and contaminating the reactor cooling system.

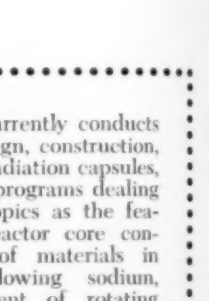
At first glance, a capsule irradiation experiment appears quite simple, and indeed, in principle, it is. However, as the number of parameters to be controlled and measured increases, the difficulties pyramid. In a broad sense, there are two related sources of difficulty: (1) lack of precise knowledge of the intensity of radiation experienced by the specimen, and (2) the need to meet highly specialized engineering requirements through meticulous design.

Nuclear Uncertainties in Encapsulation

From the capsule designer's viewpoint, the most troublesome nuclear uncertainties lie in the distribution of unperturbed neutron flux in the reactor's irradiation space and in the degree to which this is disturbed when a capsule is inserted. Reactor flux distributions can, within limits, be predicted by complex analytical techniques or they can be measured experimentally. The most widely used experimental procedure is to measure the activity of a specially compounded material (dosimeter) of known activation rate which has been exposed in the irradiation space for a given period. While such techniques are well established, the resulting flux data lack precision. Moreover, local reactor fluxes can undergo significant changes with time as a result of fuel burnup, variations in control-rod position, accumulation of fission-product poisons (materials which absorb neutrons parasitically), and insertion or removal of adjacent experimental devices. Naturally, the results of such changes are of particular concern in the design of long-term irradiation experiments.

As a result of neutron capture, the flux experienced by an encapsulated specimen is invariably lower than the unperturbed flux. First of all, a fraction of the total number of neutrons which enter the capsule is absorbed by the walls and other nonspecimen components of the capsule. This effect may be overshadowed by neutron capture in the specimen itself if

John Stang, who currently conducts research on the design, construction, and operation of irradiation capsules, has participated in programs dealing with such varied topics as the feasibility of power-reactor core configurations, creep of materials in high-temperature flowing sodium, and the development of rotating seals for high-pressure, high-temperature helium turbomachinery applications. In another area, he has contributed significantly to investigations of corrosion in high-temperature fused-salt, liquid-metal, and molten-hydroxide circulating reactor systems.



Dr. Simons coordinates studies on nuclear reactor-materials performance, corrosion, irradiation-capsule technology, and general reactor components. In his more than 15 years at Battelle he has participated in numerous studies on reactor problems. These include investigations of the corrosion in and components for fused-hydroxide, molten-salt, liquid-metal, and supercritical water systems; feasibility studies on power-reactor core configurations; and analyses of the heat-transfer, stresses, and fluid-flow in gas-cooled reactor systems. His broad professional activities include co-editorship of the AEC quarterly publication *Reactor Core Materials* and membership on the editorial board of the journal *Wear*. Simons had a key role in the preparation of *Nuclear Reactor Plant Data, Power Reactors* and edited *Nuclear Reactor Plant Data, Research and Test Reactors*, published by the American Society of Mechanical Engineers and McGraw-Hill.

it is a strong neutron absorber, as in the case of a nuclear fuel or control material. An estimate of the net flux depression attributable to the ingredients present in a particular capsule can be derived analytically. However, in most practical cases, empirical "correction factors" must be applied to compensate for the fact that idealized conditions assumed in theoretical treatments are not met.

These "correction factors" are based on experience from previous irradiations in the same reactor, wherein effective fluxes had been determined directly from postirradiation fuel burnup or dosimeter activation analysis. Inasmuch as different reactors have different performance characteristics, it is not surprising that the empirical flux-depression factors vary from one reactor to another. In fact, different regions of the same reactor require different treatments because of wide variations in neutron-energy spectra. In spite of all these uncertainties, reactor flux distributions have been mapped sufficiently well, and capsule perturbation factors can be estimated with enough accuracy, to formulate realistic effective flux values as a basis for engineering design.

High Materials and Reliability Standards

Let us examine the engineering aspects of the design of irradiation capsules. First of all, the choice of structural materials is governed by a variety of requirements, viz., nuclear characteristics which provide minimum perturbation of the desired flux, resistance to corrosion by reactor coolant and any other environments involved, resistance to radiation damage, acceptable strength, and fabricability. The materials which best fulfill these specifications are certain austenitic stainless steels, particularly those very low in neutron absorbers like cobalt, boron, and tantalum. For low-temperature irradiations, aluminum is frequently used.

Normally, in research work, an experiment will undergo systematic "debugging" after the apparatus has been set up in the laboratory. This privilege is denied in irradiation experiments, because soon after the irradiation begins, the parts become too radioactive for direct maintenance. From this viewpoint alone, it is essential that the capsule be designed with emphasis on reliability. An additional and perhaps more important reason stems from the basic containment function. Reliability is mandatory in cases where capsule failure would result in the escape of radioactive products, endangering personnel, and necessitating laborious decontamination of an elaborate reactor facility. It is not unusual for the reliability problems to be compounded by the requirement that a capsule

EVOLUTION OF A TYPICAL IRRADIATION CAPSULE

What is required

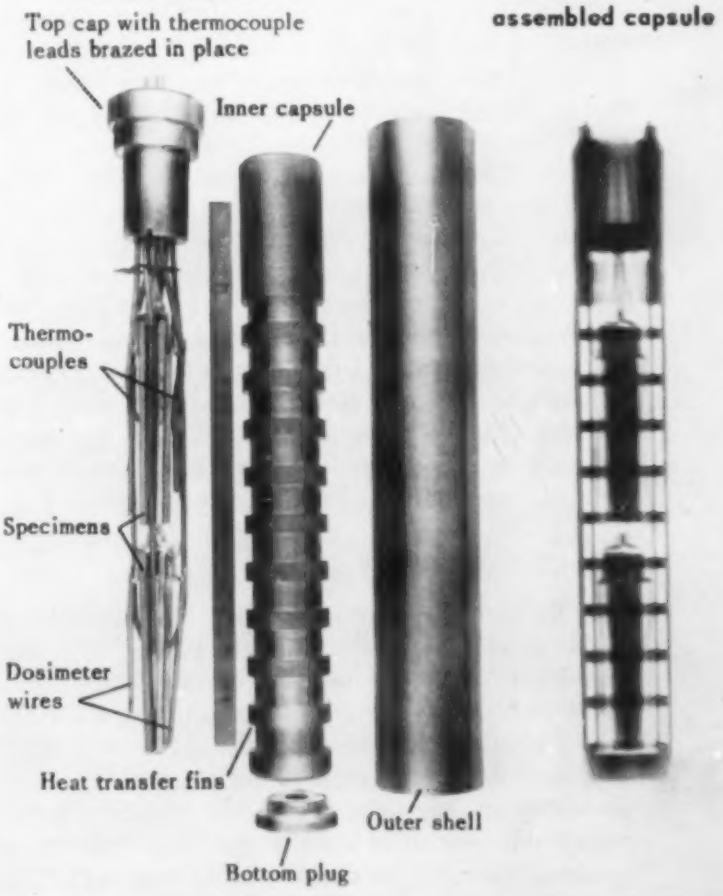
Specimens – Clad wafers containing uranium-zirconium alloy
Centerline temperature – 800 F ± 75 F
Fission burnup – 35 per cent of the U 235 present in approximately 4 months in pile

How the requirements are met

GENERAL
Structural material – Stainless steel
Configuration – Double wall
Number of specimens – 2 pairs
Heat transfer scheme – Inner capsule, NaK Annulus, Fins
Thermocouples – 6 present in NaK space
Dosimeters – Nickel-cobalt wires

NUCLEAR
Specimen thermal neutron flux – 1×10^{14} nv
Unperturbed thermal neutron flux – 2.1×10^{14} nv (based on a computed perturbation factor of 0.48)
Fission heat production – 1½ kw per inch of specimen

Finished components **Radiograph of assembled capsule**



retain its integrity during literally years of irradiation. Because of the serious consequences attending radioactive-product release, each capsule design must be approved by a qualified "Reactor Safeguards Committee".

Problems of Heat Transfer in Capsules

While a capsule must fulfill rigid reliability standards, it should also provide for irradiation of the specimens under practical conditions of temperature and flux. Because radiation damage, particularly in fuel-bearing materials, is commonly dependent on temperature, control of specimen temperature can be high on the list of engineering problems. The trick here is to design heat barriers into the capsule so that the specimen will ride at the desired temperature while the heat generated internally is being dissipated. If there is too little resistance to heat flow away from the specimen, its temperature will be too low; conversely, the specimen will overheat if the resistance to heat flow is too great.

Capsule Size Limitations

Design for proper heat transfer is one aspect in particular that would be simplified if there were no restrictions on capsule dimensions. Enlarging the size would make it possible to control heat flow from the capsule merely by making suitable changes in the length of the heat flow path. However capsule size must be tailored to fit reactor test cell dimensions, which are generally small, particularly in high-flux regions. Of course, there are other considerations which lead to a size limitation, not the least of which is the high cost of reactor space. In the Materials Testing Reactor, most of the standard test cells cannot accommodate capsules larger than 1⅛ inches in OD. In the Battelle Research Reactor, irradiation spaces in the core are created by the removal of 3- by 3-inch fuel-element sub-assemblies. For these, the recommended maximum capable diameter is 2¼ inches.

Single-Wall Capsules

Of the three ways of transferring heat, conduction is the most flexible for dissipating heat from encapsulated specimens because various heat-transfer media with a range of thermal conductivities are available. Radiation can become significant only in high-temperature experiments, whereas convection usually plays only a minor role at best. The simplest capsule conceivable consists of a sealed gas-filled shell with a specimen mounted in the center. In this case, heat dissipation from the specimen is by conduction through the gas and radiation to the enclosure wall. Because of the low thermal conductivities of gases in general, this scheme is limited to cases where the nuclear heat production is low and the desired specimen temperature is high. For example, it is more or less ideally suited to the high-temperature irradiation of structural materials, where heat is produced at a relatively low rate by the absorption of gamma rays in the specimen.

When fueled specimens are involved, however, a gaseous medium is generally too poor a conductor to handle the larger heat-generation rates without letting the specimen temperature soar. In this case, a liquid might be substituted for the gas, but most liquids have serious drawbacks for this application. For example, water has the disadvantage of very high vapor pressures, even at moderate temperatures. Organic fluids suffer from radiation damage if high dosages are involved.

Low-melting molten metals are not subject to such shortcomings and hence have come into common use as capsule heat-transfer media. The most popular one is a sodium-potassium alloy (NaK) which is liquid at room temperature. Although its strong chemical reactivity is objectionable, this can be dealt with by using well-established inert-atmosphere handling techniques. Since the thermal conductivity of NaK is high (about 100 times that of helium, a high-conductivity gas) a shell containing NaK-immersed specimens provides the means for dissipating large amounts of fission heat without letting the specimens overheat.

Double-Wall Capsules

In-between cases, where the power is too great to be dissipated by gas conduction alone and too little for NaK alone, are the most common. These are usually handled by resorting to "double-wall" capsules. Here the specimen is mounted in the center of two concentric capsules. The temperature and heat-flux requirements are met by utilizing a suitable combination of heat-transfer media in the specimen cavity and in the narrow annulus between the two containers. In the usual case, NaK surrounds the specimen in the inner chamber, and the annulus conductance is tailored to provide the desired heat-dissipation rate.

When a relatively small amount of heat is to be dissipated, the annulus is filled with a gas. Heat is transferred across the annulus by both conduction through the gas and thermal radiation between the enclosure walls. The major part of the temperature drop from specimen to cooling water occurs across this annulus. If temperature levels are fixed, the amount of heat

transferred by radiation depends on surface emissivities which are high in the case of well-oxidized stainless steels and much lower for reflecting materials such as aluminum. Thus some control of heat flow is available through selection of appropriate materials.

More latitude in heat flow regulation can be achieved by controlling the conduction between the annular walls. For example, the space can be evacuated to reduce conduction heat flow to practically zero. If a conducting medium is used in the annulus, heat-flow control can be achieved by varying the width of the annulus and by using media of different thermal conductivities. Filling the annulus with argon, a low-conductivity gas, allows for a small amount of conduction heat transfer. Higher rates may be obtained with helium, since it has roughly ten times the thermal conductivity of argon. Argon-helium mixtures can provide fine control, since the variation of conductivity with composition is continuous, though not quite linear.

If the heat to be dissipated is higher than can be handled by helium in the thinnest practical annulus, the next step is to employ metal fins that connect the inner crucible and the outer shell. From the heat-transfer viewpoint, the factors important in fin design are thickness, conductivity of materials used, and radial length. One problem introduced by fins is that of obtaining fin-wall joints which do not restrict heat flow or thermal expansion. Furnace-brazing techniques may be used to obtain metallurgically bonded joints. It is usually more satisfactory and much simpler, however, to design for assembly with a light press fit, which provides good thermal contact as the capsule expands on heating. Another minor problem with fins is temperature scalloping, the severity of which can be minimized by dividing the desired amount of heat-transfer material into the maximum number of fins consistent with good fabrication practices.

Uncertainties in Heat-Transfer Analyses

In the simplest case, where a cylindrical specimen is centered within a capsule and where axial heat flow can be neglected, straightforward two-dimensional heat-transfer calculations can be used for design purposes. However, even these are subject to uncertainties in factors such as wall emissivities and mean thermal conductivities of gases. The latter stems from the fact that gas conductivities increase substantially with temperature. There is no good way to ascertain the mean temperature in a narrow annulus with a high gradient, inasmuch as the temperature profile is undoubtedly altered by thermal convection of the gas.

Frequently, noncylindrical specimens (e. g., spheres or thin rectangular wafers) are irradiated in cylindrical capsules. The heat transfer in such configurations is generally not amenable to exact analytical treatment. Such cases can be handled in either of two ways. One entails making enough simplifying assumptions to permit an analytical solution (common examples are treating a noncylindrical specimen as a centered rod of equivalent volume or perhaps surface area, regarding certain circumferential surfaces as isothermal, and ignoring axial heat flow). The other entails the use of numerical or analog techniques to arrive at the heat-flow conditions. Though superior to the first method in reliability of the answers, the latter approach can be very laborious, especially if three-dimensional heat flow is involved. Actually, because all capsules are subject to thermal end losses, axial heat flow can never be ignored completely. Naturally, it becomes more and more important as the length-diameter ratio of the specimen decreases.

Advantages of Temperature Monitoring

In spite of the inevitable question marks attending capsule heat-transfer, fairly sound engineering designs can be made on the basis of paper studies fortified by in-pile performance data from previous experiments. Even so, direct monitoring of temperatures inside a capsule during an irradiation is certainly advantageous. The standard technique is to do this with thermocouples located near the specimens and sealed through the top of the capsule; the leads are brought out of the reactor to instrumentation through a closed lead tube welded to the capsule body. Common thermocouple materials, such as Chromel, Alumel, copper, and constantan, can be used. These are available commercially as high-temperature-alloy-sheathed, ceramic-insulated assemblies with sheath diameters as small as 40 mils. Special techniques have been worked out for forming junctions and sealing the sheaths around them.

Thermocouple placement is often a vexing problem. Ideally, the junction should be located exactly at the point of interest, e.g., the surface or center of the specimen. In most cases, however, it is undesirable to disturb the specimen surface. The only alternative is to locate the thermocouple bead somewhere near the specimen surface and obtain the temperature of interest by adding an analytical correction to the reading. This correction is highly sensitive to the distance between the junction and the surface, particularly when the temperature gradient across this distance is large. Consequently, the accuracy of correction depends upon the precision with which the thermocouple-junction location is known. It is not uncommon

for a location uncertainty of only a few mils to give rise to a specimen-surface temperature error of 100 F or so.

Internal Heating and Temperature Control

Despite such limitations, thermocouples provide valuable temperature data. However, even a well thermocoupled capsule experiment loses part of its value if the specimen temperature during irradiation differs appreciably from the design level. As discussed previously, such a situation can easily stem from cumulative errors in predicting neutron densities and heat transfer. For this reason, it is desirable to have a source of heat within the capsule which can be varied independently of the reactor operation. This allows the total capsule heating to be adjusted to a rate necessary to maintain the desired specimen temperature in spite of uncertainties inherent in the design. The common technique for doing this is to coil small-diameter metal-sheathed, ceramic-insulated resistance heating elements around the specimen. The lead sections are sealed into the capsule by brazing the sheaths at their points of entry through the heater. The heater output is controlled by instrumentation outside the pool actuated by a thermocouple inside the capsule.

Problems in Mounting Specimens

Mounting of specimens within a capsule is an important consideration. First of all, they should be held firmly enough to prevent movements during capsule handling that would change their positions with respect to fixed thermocouples or destroy heat-flow symmetry. On the other hand, they must be supported in such a way that they are free to undergo thermal or radiation-induced distortions without restraint.

These mounting requirements are not too hard to meet for fueled specimens with generous metallic claddings. Such specimens can, for example, be suspended by the cladding frames with either pins or clamps. However, this straightforward approach is not feasible with certain other types of specimens; e.g., bare ceramic fuel samples like sintered UO_2 or UC. Schemes which have been used to mount such specimens include cradling in wire-mesh baskets, stacking in spring-loaded columns, and nesting in a bed of powdered material in an appropriate cavity.

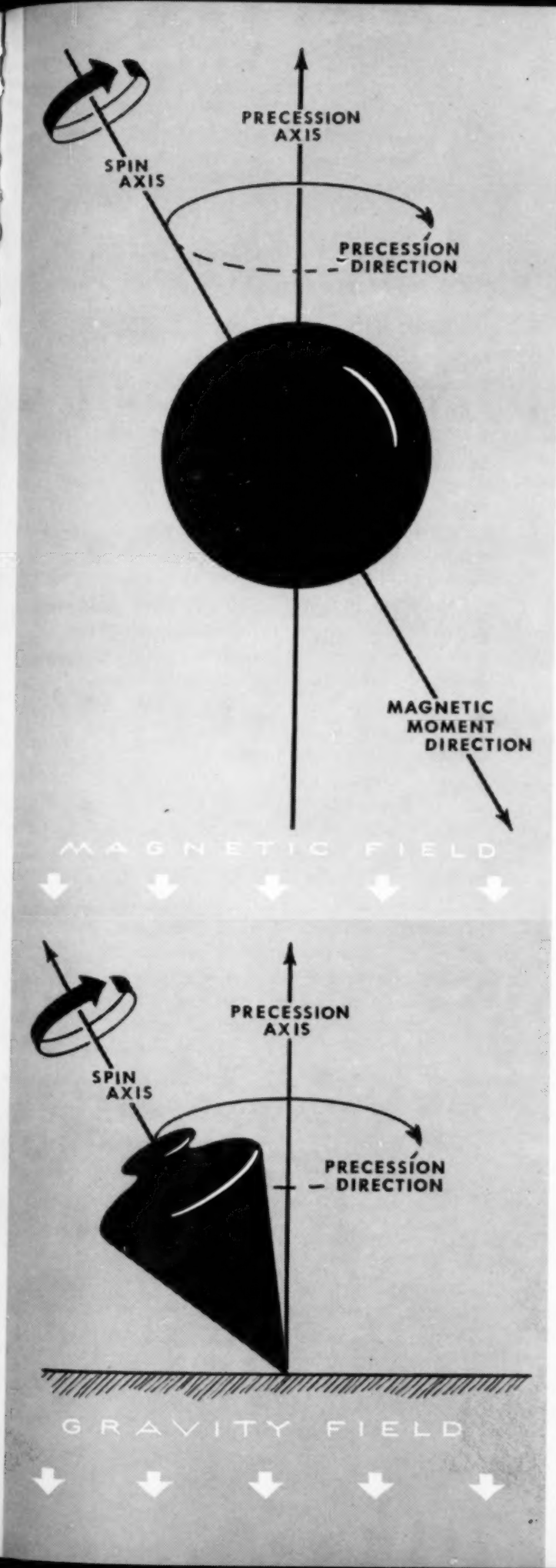
Disassembly in the Hot Cell

The final item to be mentioned here is the importance of designing capsules so that operations required for postirradiation evaluations can be carried out conveniently by remote handling. Hot-cell examinations provide the only concrete evidence of what the irradiation did to the specimens. After all, obtaining this information is the whole objective of any irradiation experiment. For example, one important effect which is commonly appraised is the amount of fission gas released from fueled specimens. When fission-gas release is to be measured, a flat area must be provided on the capsule surface to accommodate a device which pierces the wall and permits the released gas to be withdrawn into a sealed collection chamber. The capsule wall in this area must be thin enough to be pierced readily, yet thick enough to preclude failure during irradiation.

Ease of specimen extraction is also an important factor, since any mutilation of the specimens during unloading might obscure some evidence of radiation damage. This means that the specimen mounting arrangement should permit remote-manipulator disassembly without brute-force tactics. By the same token, any internal dosimeter wires must be easily detached and identified so that the indicated radiation dosage can be associated with the correct specimen zone.

Conclusion

It should by now be apparent that a meaningful irradiation-capsule experiment involves somewhat more than just sticking a specimen into a radiation field and watching how it behaves. This simplified concept soon disintegrates when one considers the multitude of requirements which must be satisfied. To do the job properly, skills in engineering and physics must be deftly combined to cope with challenging problems involving heat transfer, stress analysis, mechanical design, instrumentation, and radiation-field characteristics. The results of previous experiments, of course, provide a valuable guidepost toward the formulation of successful new capsule designs. Nevertheless, the design of radiation-damage tests is still an art. There is little question that techniques born out of ingenuity and experience will gradually convert it to an established science.



Electron Spin Resonance

Expanding studies are opening new vistas of of application for electron spin resonance. The author describes the phenomenon and discusses how its usefulness may extend beyond the maser to probing the mysteries of solid-state physics.

by William B. Gager

In 1946, R. L. Cummerow and D. Halliday in the U.S. and E. Zavoisky in the U.S.S.R. examined the behavior of certain manganese compounds when these compounds were subjected to microwave radiation simultaneously with an applied steady magnetic field. It was discovered that these compounds exhibited a sharp absorption of microwave energy when the microwave frequency and the magnetic field satisfied a certain relationship. Since these compounds had the special attribute that one of the atoms present had unpaired electron spins, the phenomenon was called electron spin resonance. The nature of this absorption is very similar to the energy absorption by a weight oscillating at the end of a spring being driven by a driving force which varies with the same frequency as the spring's resonant frequency.

1. *The precession—change in axis direction—of the spinning top helps to explain the quantum-mechanics phenomenon of electron-spin resonance. Much as the top (below) precesses because of gravity, the spinning electron (above) precesses because of the action of the magnetic field upon it. This can happen only when unpaired electrons are present as in compounds of the iron and rare-earth groups of elements.*

Since its discovery, electron spin resonance has been extensively investigated, with the major work being done at Oxford University in England. In this discussion, we will present the basic ideas underlying research on electron spin resonance.

The Basic Resonance

The phenomenon of electron spin resonance is basically a quantum mechanical effect. In fact, there is no classical physics analogue of electron spin. Fortunately, however, electron-spin resonance can be explained, albeit empirically, by referring to spinnings tops and the solar system. This will allow us to use a semi-classical approach involving the concept of angular momentum and proceed from there with our discussion.

Let us for the moment consider the motion of a spinning top. After the top has been set spinning, one notes that it is very difficult to change the direction of the axis about which it is spinning. When a force is applied to one end, the top begins to rotate slowly in a direction perpendicular to the applied force and to the axis. This slow rotation is called precession. When the top is set spinning on the ground with its axis not vertical, this precessional motion occurs. The precession results from the action of the force of gravity on the angular momentum of the spinning top. As the top's angular momentum, and thus the rotational energy decreases, it precesses more and more and finally falls over and stops. The angular momentum of the top consists of two components, the spin about its axis and the precession which is about an axis defined by the applied force. As long as angular momentum is conserved, the precession increases at the expense of the spin. For the top to fall over and stop, some mechanism must be found to remove angular momentum from the top. This is accomplished by friction.

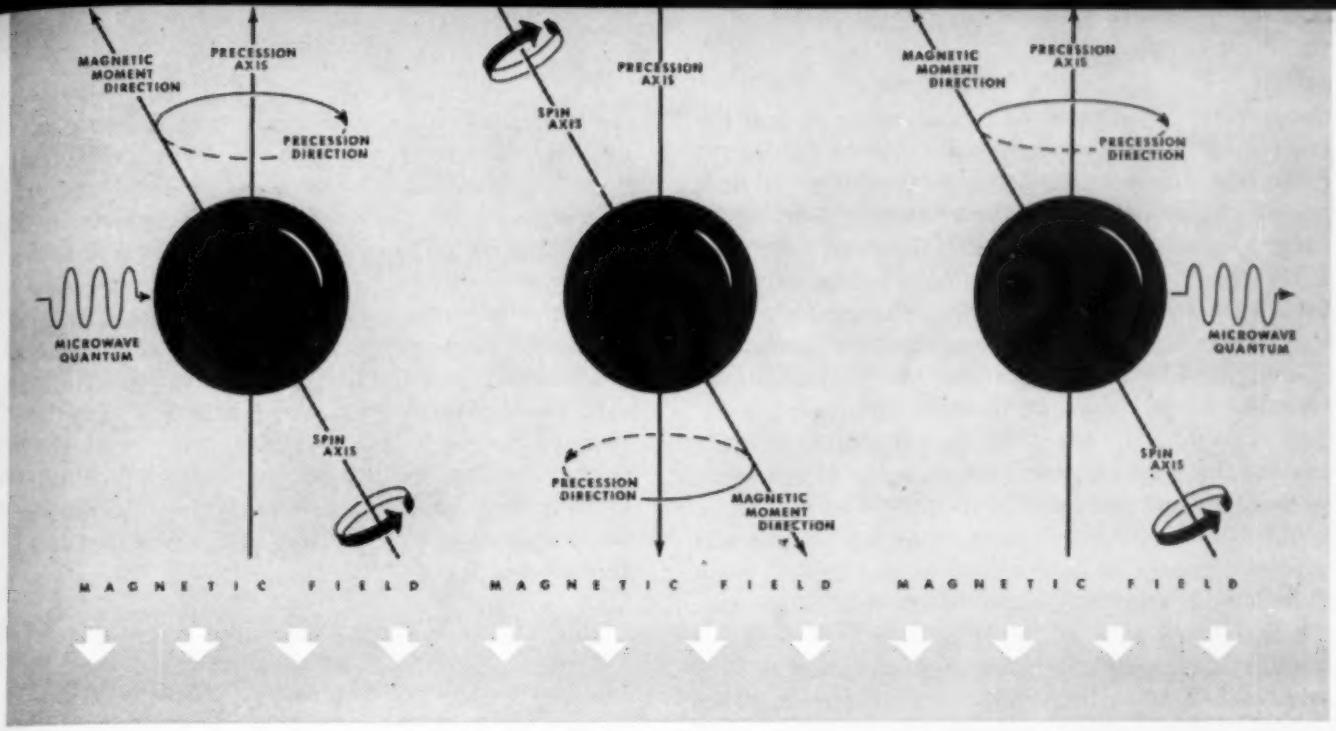
Similar phenomena can occur with electrical circuits. A current of electricity gives rise to a magnetic field, and if this current is flowing in a closed loop, this loop, through the field generated, possesses what is called a magnetic moment. If we should place this current loop in a magnetic field, the interaction between this field and the magnetic moment of the loop will cause a torque to act tending to align the moment along the field direction. Thus the magnetic field acts on the current loop much as gravity acts on the mechanical top.

In translating the state of affairs existing in the atom in terms of the above classical pictures, one pictures two separate contributions to the atom's magnetic moment. First there is the orbital contribution where the electron moves in a closed path about the nucleus in a manner similar to the earth moving about the sun. This is called the orbital motion, and it possesses angular momentum and a magnetic moment. For our discussion this aspect is unimportant and will be neglected. Second, there is the all-important contribution of the electron's intrinsic spin. This may be thought of as its rotation about some axis through the electron, somewhat in the manner of the earth spinning about its polar axis. It is this second contribution which contains the magnetic moment and angular momentum in which we are interested, and the discreet changes of direction of these quantities give us our spectra.

In most atoms or compounds encountered, all the electron spins are paired off. This means that each electron has a twin so that their magnetic fields cancel each other and there is no net magnetic moment or angular momentum. But fortunately for the spin resonance phenomena, some atoms, such as those of the transition groups like the iron group (Ti, V, Cr, Mn, Fe, Co, Ni, Cu) and the rare earth group (Ce, Pr. Nd, etc.), appear in compounds with some electrons unpaired and so magnetic moments exist. These compounds are called paramagnetic and their magnetic properties are primarily due to the unpaired spins. Other chemical species, known as free radicals, also have unpaired electron spins, and they also have interesting magnetic properties.

These spinning electrons act like the top we discussed. Here, when a magnetic field is applied, the field acts in a sense analogous to gravity and the force it exerts upon the electron's magnetic moment tries to force the electron's moment into alignment with the imposed field. This latter force causes the electron to precess much as the top did. The spinning of the top gradually slowed because it gave up its energy to frictional forces, but the electron, not bothered by such forces, keeps on spinning and precessing.

Dr. Gager's interest in electron-spin resonance is an outgrowth of his studies for the doctorate at Ohio State University. His research activities at Battelle have been directed to investigations in the same field, principally to the study of diverse materials for use in the preparation of masers. Earlier, while associated with the Bureau of Standards, he had conducted studies of electron-spin resonance at low temperatures. Gager holds membership in the American Physics Society and the Institute of Radio Engineers.



2. *A diagrammatic representation of how an electron responds to a photon of microwave energy. Left, the electron is in a low-energy state ready to absorb a photon. Center, the photon absorbed, the electron has precessed and is in a high-energy state. Right, when the photon is emitted from the electron, the latter returns to a low-energy state and is ready to receive another photon.*

The electron cannot change its angular momentum as the top does unless there is some mechanism by which it can exchange energy with its surroundings. A similar situation is the top we call the earth. It too keeps on spinning and précessing since it is only very weakly coupled to any forces that might slow its spin. For the electron, this transfer of energy will take place by microwave radiation. Thus, for a frequency of ten thousand megacycles, a magnetic field of about thirty-five hundred gauss will produce resonance and hence a change of the electron's rotational energy. This change is manifested by a change of the direction of the electron's spin axis, and thus a change of direction of its magnetic moment.

Unlike the top, where the energy is degraded in a continuous manner, the microwave energy is absorbed by the electron spins in very small but still finite quantities called "photons" or light quanta. These quanta are all the same magnitude so that in each instance the same amount of microwave energy is absorbed. Our instruments thus record an absorption line at one discrete frequency. The electron can also emit a quantum of energy, and the probability for each of these processes is equal. Since our systems contain more electrons in a condition to absorb energy than to emit it, however, the net effect is absorption.

The electron can also give up its energy in the form of heat energy or thermal quanta in finite amounts to the crystal or liquid of which, with its atom, it is a part. We considered the photons as both giving energy to and taking energy from the electron spins, but in the case of the thermal quanta (phonons) we consider the removal of energy as the preponderating effect. We consider the effect in this manner because for the usual operating temperatures there are extremely few phonons of the appropriate energy to interact with the spins. The vast majority of these interactions are the type where the spin creates a phonon and thus loses its energy. It is this effect, energy not being returned to the microwave field but to the lattice as heat instead, that permits the net effect of energy absorption to occur. A highly interesting phenomenon can occur when high values of microwave energy are employed. The phonons become unable to carry away appreciable energy, and we find that the spins are effectively only absorbing and emitting photons at an equal rate. The net effect is no energy absorption, and we say that we have saturated the resonance. The transitions are still occurring, but they are undetectable. This points out that the transfer of energy to the solid or liquid as heat is necessary to observe the phenomenon.

Crystal and Molecular Effects

The points which we have discussed above are the main reasons why we can obtain a resonance. There are two or more energy levels based upon orientations of

the precession axis involved in the resonance, and the transitions of energy are usually between adjacent levels. The difference in energy between these levels is governed very strongly by the environment or chemical properties of the medium that the atom electron is in. For free atoms, acted upon only by the magnetic field, all precession energy differences are equal and the various resonance transitions coalesce giving one line in the electromagnetic spectrum. This is uninteresting beyond showing that the atom has a resonance. Fortunately, when the atom is combined into a molecule or a crystal, other effects occur which allow us to infer some properties of the atom's surroundings.

We mentioned earlier that the spinning electron was precessing about an axis defined by the applied magnetic field. If now the electron is attached to an atom which is itself in a molecule or a crystal, then the neighboring atoms will, since they are built of electrically charged particles, also exert an electrical force on the atom. This then defines a new axis which competes with the magnetic field in a contest to determine which will be the axis of precession. The detectable phenomena which this brings about show up if there is more than one transition the spinning electron can make. Each transition will occur at a different energy, or we say the resonance line is split into more than one component. The magnitude, and variation of magnitude of this splitting, as the crystal is rotated in the magnetic field, allow us to determine the strength and symmetry of this electric field.

The number of transitions per atom will permit us to measure the value of the angular velocity of the spinning electron, and after lengthy computation, some molecular constants can be determined. This method complements X-ray crystallography, but does not overlap its domain. X-rays will find and locate the major atomic sites in a crystal, while our technique determines microscopic symmetries in the close vicinity of the ion examined. If there is only one transition, then our job is difficult since we must infer from the changes of position of this line what the molecular and crystal forces are.

One method of considering the crystal forces is to assume that all atomic electrons will, at a given frequency, resonate at the same value of magnetic field. Since we then observe that the actual value of the field for resonance is different each time, we say that the molecule has an internal field, the value of which is the difference between the free atom resonance and the molecule resonance fields. As the reader might have guessed by this time, some of these calculations become quite involved.

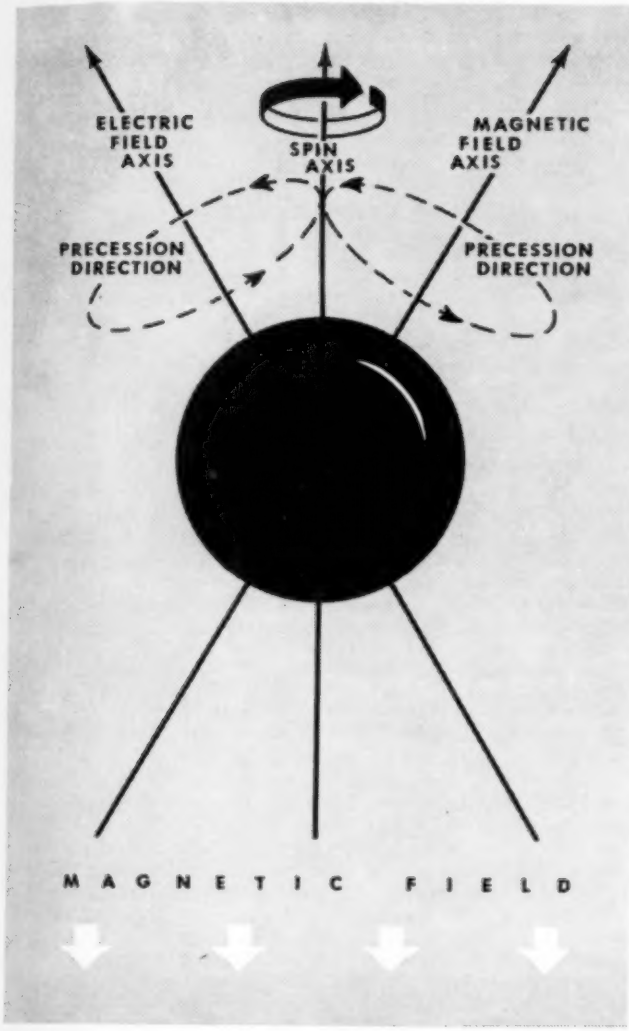
The basic apparatus for doing this work is, in principle, quite simple; all that one needs is a source of radio-frequency energy at microwave frequencies, a magnet, and a sample. The actual details can become quite complicated, but these are technical and will only be indicated. Since we deal primarily with microwaves, the radio-frequency energy is contained in systems very similar to radar except that the radiation is kept in waveguide enclosures at all times. For good results the frequency is kept constant to one part in one million. Since the frequency is kept constant, the experimenter will vary the magnetic field, and he is therefore forced to use an electromagnet in which the field changes when the current through it changes. Complication is introduced at this point because unwanted changes of the field must be one part in ten thousand or less.

Uses of Electron Spin Resonance

Let us at this time suppose we have taken the spectrum of a substance, say a free radical. We know only two things about the spectrum, the frequency at which our instrument was operating, and the value of the magnetic field at which the various lines occurred. The program now is to fit our numbers to an equation which contains a set of unknown constants, and then to evaluate these constants. If our sample were in the form of a single crystal, we would want to know how these constants varied with angle. This is accomplished by rotating the sample with respect to the magnetic field.

The theoretician has been at work during this time. He has been determining values for these constants based upon various assumptions concerning the substance with which we are working. By comparing the values of the experiment with the theoretical values, a choice can be made from the models and we will eventually arrive at a fairly good idea of the electronic structure and magnetic properties of our sample.

We now know quite a bit about our material as we have seen from above. We have a constant which gives us the electric fields of the surrounding atoms, and another constant which determines an effective magnetic field from the local surroundings. Under very good conditions it is sometimes possible to measure an interaction between the electron and the nucleus of its atom. When this occurs, we achieve a bonus so to speak. We can now measure the average distance of the electron from the nucleus, the type of chemical bonding, and the magnetic moment of the nucleus. In some free radicals, diphenylpicral-hydrazyl for example, it has been found that the electron spends its time around more than one nucleus; and in some cases we can estimate the percentage of time for each nucleus.



3. *Electrons may precess because of the electric field created by the atoms in the surrounding crystal structure. When such a field is not parallel with an applied magnetic field, both the electric and magnetic fields compete for the electron's precession.*

What has been shown above is, in outline form, how the experimenter interprets his data. The technique is similar for all the materials studied. There often arises the question as to whether the equation you have chosen is the correct equation, and this question becomes the more serious as more significant figures are carried in your data. At the present time, five and six place accuracy is not at all unusual. In some experiments, the accuracy is better than the accuracy of the present standards, thus leading to results which can only be expressed as a ratio to other results; e.g., the ratio of the magnetic moment of the electron to the magnetic moment of the proton. This situation is arising because of the high precision with which we can measure frequency as compared to the value of an electrical current.

Reaction rates in chemical reactions are now being studied by watching the resonance absorption line as a function of time. Changes of relative intensity tell us which compounds are reacting, and by measuring various quantities such as line width and intensity as functions of time we can estimate the reaction's speed.

A few years back, it was discovered that in a few systems then under examination the possibility existed of putting the electrons into a condition where they would emit rather than absorb energy. This led to the development of a device, the Maser, which amplifies microwave signals such as are received by radar sets. A weak signal is picked up by an antenna and fed into a resonance spectrometer. When this signal arrives at the sample cavity, the sample is stimulated and thereby emits radiation of the same frequency. Thus the original signal is reinforced or, as we say, amplified.

The development of this device has stimulated the growth of this field. Today, many laboratories are devoting extensive time and money toward studying materials usable in masers and toward a better understanding of the phenomena through which they work. It is interesting to point out at this time that some of the synthetic gems appear to have very promising properties in this application. The maser amplifier mounted in the radio telescope at the Naval Research Laboratory uses a synthetic ruby as the working material.

The Future

We have mentioned one practical use to which spin resonance has been put, the maser. It is at this stage too early to say what the future of this instrument will be, but it has definitely established itself as a very great aid in radio astronomy. Work is now proceeding in development of this and related microwave devices.

Over and above any applications to instrumentation and device work, there exists a large field of work where this technique will be used very extensively—that very large area of research known as solid state physics. At the present time, scientists are using this tool to probe deeper into the mechanisms of bonding and electrical conduction of crystals. The magnetic properties of materials will continue to receive attention since through a knowledge of these properties a greater understanding of the electronic structure of matter can be obtained.

Chemistry is likewise beginning to reap benefits through investigation of free radicals and chemical reactions. These experiments are even now deeply involved in a study of photosynthesis, and it is apparent that free radicals are being generated by the action of light. This subject, like so many of the others, is still in the initial stages, but much is hoped of the results.

Writings by STAFF Members

Proceedings of the Conference on Carbon, Pergamon Press, Inc., contains the following writings by staff members:

Crystal Structural Properties of Carbon Blacks. A. E. Austin, pp. 289-403.

The crystal size and amount of disorganized carbon were studied in a number of carbon blacks, with respect to different pyrolysis processes and fuels. The residual hydrogen content is related to the variation in structure and process. The structure of the carbon black is described in terms of the per cent of disorganized carbon, of parallel graphitic layers, and nonparallel layers.

Annealing of Crystal Distortion in Irradiated Graphite. A. E. Austin and R. J. Harrison, pp. 595-605.

Fast neutron irradiation damage to crystalline of artificial graphite was observed by means by X-ray diffraction techniques. The interlayer distortions and crystals spacing recover at lower annealing temperatures than do the interlayer distortions. The nature of the intralayer distortions was studied by Fourier analysis of line shape. It was concluded that this distortion is principally an inhomogeneous strain and that there is little crystal breakup for irradiations less than 1000 MWd/ton.

New Directions in Reliability Engineering. Kenneth E. Cochran. *Military Electronics*, June, 1959, pp. 13-16.

Discussed is the concept of (1) setting reliability requirements, (2) design analysis, (3) development of evaluation techniques, (4) quality control, (5) quality assurance, (6) specification engineering, (7) environmental evaluations, (8) failure analysis, and (9) data analysis and presentation.

The Role of the Hard Dot Positive in the Gravure Process. James M. Dugan and T. A. Pine, *Gravure*, v. 5, June, 1959, p. 16 + 4 pages.

Rather than being a unique factor, dot hardness is only one of many process elements that influence print quality. Just how important dot hardness is cannot be finally determined until its effect has been unwoven from the multitude of other equally important factors, by carefully designed and controlled experiments.

Acetylenic Alcohol-Inhibited Pickling Bath as a Pretreatment Prior to Lining Steel Pipe. K. N. Edwards, L. J. Nowacki, and E. R. Mueller, *Corrosion*, v. 15, May, 1959, pp. 275-278.

Acetylenic alcohols when used as inhibitors in pickling baths provide a substrate which will increase the corrosion inhibition of epoxy-phenolic systems under extreme immersion conditions. This substrate under test conditions provided protection equal to or superior to that provided by lightweight zinc phosphate pretreatment.

Platinum-Flux Technique for Determining Oxygen in Titanium. W. R. Hansen, M. W. Mallett, and M. J. Trzeciak. *Analytical Chemistry*, July, 1959, pp. 1237-1241.

An investigation was made of the reproducibility of the Pt bath technique for determining O in Ti and its alloys. The accuracy of the dry-crucible and the Pt-flux techniques as applied to unalloyed Ti, and one alloy, Ti-6Al-4V, was determined by using standard samples. Both techniques appeared capable of recovering at least 92 per cent of the O in unalloyed Ti standards. Average O recovery from Ti-6Al-4V alloy standards was 93 per cent by both the Pt-flux and the dry-crucible techniques. Studies on the reproducibility of analytical values made on three other alloys, Ti-8Mn, Ti-2Fe-2Cr-2Mo, and Ti-5Al-2.5Sn, indicated that satisfactory results could be obtained by both techniques.

Ceramic-Coated Copper Wire. Burnham W. King, George D. Kelly, Winston H. Duckworth, and Jack H. Terry, *American Ceramic Society Bulletin*, v. 38, May, 1959, pp. 251-255.

The development of a ceramic coating for copper wire is described. The coating is a special porcelain enamel, applied in a continuous process. The coated wire was evaluated using adaptations of the methods standard in the industry for insulated wire. Ceramic-coated wire produced on a pilot-plant scale was used successfully to wind specialty transformers and fractional-horsepower motors.

Solder Bonding Aluminum to Uranium. J. W. Mishler, J. T. Niemann, R. P. Sopher, and D. C. Martin, *Welding Journal*, v. 38, June, 1959, pp. 268s-272s.

This study was undertaken to determine if flat-plate fuel elements could be produced by solder bonding aluminum sheets to a uranium core. It was necessary to plate the uranium with chromium, iron or nickel, which served as a diffusion barrier. The solders used were lead, tin, zinc, and their alloys. No provision was made for removing surface oxides on the base metals. Therefore, it was necessary to plate the aluminum and the uranium diffusion barrier. The best bonds were produced with aluminum plated with 0.5 mil of copper and nickel-plated uranium given a copper flash. Corrosion tests on bonded samples showed zinc was the most corrosion-resistant solder tested.

Powder Metallurgy in Reactor Technology. (In German.) Die Pulvermetallurgie in der Reaktortechnik. R. Palme, *Metall*, v. 13, May, 1959, pp. 386-389.

Products can be made by powder-metallurgical methods which have properties unobtainable by other fabrication processes. Reviews methods for producing fuels and structural materials for reactors, such as hydrostatic pressing for cylindrical elements, hot-pressing for nonporous refractory structures, and sintering of uranium compounds. Uranium carbide and oxide structures have been fabricated which have good stability, creep, and corrosion properties at elevated temperatures.

The Nonmetallic Constituents of Steel. Clarence E. Sims. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 3, June, 1959, pp. 367-393.

Gives the origin, modes of formation, and characteristics of nonmetallic inclusions in steel. Exogenous inclusions have their principle source in ladle refractories. Endogenous inclusions are formed mainly during cooling and freezing. The importance of inclusions is largely in their effect on mechanical properties.

Molded Sections of Powder Metallurgical Origin, Especially Strip Made of Zinc and Zinc-Lead Alloys. (In German.) Pulvermetallurgise hergestellte Formkorper, insbesondere Bander, aus Zink und Zink-Blei-Legierungen. H. Weik, G. Ogiermann, and R. Ergang, *Metall*, May, 1959, pp. 398-404.

Sinters and strips of Zn and Zn-Pb powder mixtures with up to 10 weight per cent Pb are studied relative to their mechanical properties, improvement by subsequent rolling, conditions of recrystallization, and resistance to corrosion in a three per cent aqueous common salt solution.

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

NOTES from BATTELLE

RARE EARTHS IN SEMICONDUCTORS

Intermetallic-compound semiconductors have been under study for some time, and many useful devices have been developed as a result of such work. One important group of metals whose compounds have in the past received little or no attention along these lines is the rare earth group. In research for a number of companies forming the Rare Earth Research Group, Battelle technologists have studied the electrical properties of the selenides of lanthanum, erbium, and yttrium and the tellurides of the same elements plus gadolinium.

As reported by J. F. Miller, F. J. Reid, and R. C. Himes, the electrical characteristics of the compounds suggest semiconducting behavior. Observed room-temperature resistivities, for example, ranged from approximately 10^{-4} ohm-cm for lanthanum telluride and erbium monoselenide to the insulator range for yttrium selenide. All the compounds studied have high melting points and show good thermal stability. The properties of certain of these compounds at elevated temperatures indicate that they may be valuable in thermoelectric generation of electricity when suitably developed.

IRRADIATION OF LEATHERS

Extensive data have been accumulated on how radiation affects innumerable materials. However, little has been reported on the effects of radiation upon fibrous proteins such as hide substance and leather. Recently, in research at Battelle, a study was made of the effects of gamma radiation on some of the physical properties of vegetable-tanned, chrome-tanned, and retanned leathers and of rawhide.

Institute technologists Victor G. Vely, Nicholas D. Gallagher, and Maynard B. Neher conducted the study; the results were recently reported before the 55th Annual Meeting of the American Leather Chemists Association. They found that the shrinkage temperature, breaking strength, and elongation properties of the materials were adversely affected. Statistical analysis showed that very high significance could be attached to decreases in properties obtained on all leathers irradiated to 10^8 and 10^7 reps (measure of irradiation in animal tissues). In general, vegetable-tanned and vegetable-retanned leathers showed greater decreases in shrinkage temperature but less loss of strength properties than chrome-tanned leather. At 10^6 reps dosage there were significant decreases in shrinkage temperature but little decrease in breaking strength and elongation properties.

AEROSOL TRANSPORT STUDY

Scientists at Battelle report the completion of a study to (1) determine the effects on the physical and biological properties of aerosols resulting from transporting these aerosols through many feet of duct and (2) determine the conditions under which an aerosol may be transported while retaining in suspension at least 80 per cent of the particulate matter in each of four particle-size intervals.

The work was sponsored by the U. S. Army Chemical Corps Laboratories at Fort Detrick, Maryland, in an effort to increase efficiency in the assessment of biological aerosols. The research was accomplished by a team of engineers, biologists, and statisticians, with Dr. J. Mason Pilcher in charge.

Data collected in the course of this study are expected to point the way to more effective use of complex equipment employed in the larger program of biological aerosol generation at Fort Detrick. By proving the feasibility of removing small and properly diluted portions of the aerosols from the large chamber in which they are generated, the Battelle staff has demonstrated how the aerosols can be evaluated, while the main generating chamber is being purged and made ready for further studies.

In experimental studies, dibutyl phthalate aerosols were moved through a 9-inch-square duct 45 feet long at transport velocities of 8.8, 88, 440, and 880 feet per minute. The aerosol particles ranged in size

from 1 to 25 microns in diameter and were tagged with one per cent Rhodamine-B dye.

The physical studies showed that, for aerosol particles 12 microns in diameter and smaller, 80 per cent or more were transported over a distance of 30 feet in the 9-inch-square duct at 880 feet per minute. Approximately 80 per cent of the aerosol particles less than 10 microns in diameter were transported 30 feet at 440 feet per minute. At 88 feet per minute, approximately 80 per cent of the 5-micron particles were transported 30 feet. For aerosol particles 25 microns in diameter, 10 to 50 per cent were transported 30 feet at 880 feet per minute.

For biological transport studies, the aerosols were generated from slurries containing either spores of *Bacillus subtilis* var. *niger* or *Serratia marcescens* or from slurries containing a mixture of these two organisms. Test conditions for these biological studies included temperatures of 15, 35, 75, and 100 F with a high and a low realtive humidity at each temperature. Transport efficiencies were studied as a function of particle size and as a function of total viable bacteria transported.

* NEW USES FOR MERCURY SOUGHT

New uses for mercury is the objective of a technical-economic study just begun by the American Quicksilver Institute at Battelle. According to Raymond W. Hale, Institute chemist in charge of the research, purpose of the study is to generate a number of new ideas for the use of mercury—ideas for either immediate application or ideas which suggest a promising area for additional research. To develop ideas, Hale and his associates will interview specialists within the research center representing a wide range of technologies. Special attention will be given to ideas involving applications in which mercury is consumed beyond recovery, but consideration will also be given to applications involving the reuse or cycling of mercury.

Describing the scope of the study, Hale said that "possible metallurgical, chemical, mechanical, and electrical applications will doubtless receive special attention. In the metallurgical field, for example, our metallurgists will consider new ideas for use of mercury in powder metallurgy techniques to produce porous metals, as well as the broad field of amalgam metallurgy. Similarly, our chemists and chemical engineers will weigh possibilities of mercury's use in the propellant field, probably as an intermediate or agent in producing exotic fuels or oxidizers. At this point, we are thinking in the broadest possible terms."

The American Quicksliver Institute was formed about two years ago, its membership comprising virtually all the sizeable mine producers of mercury in the United States.

* ALASKAN RESOURCES STUDY

A long-range economic appraisal of the resources and transportation facilities of northwest North America is under way at Battelle for the Alaska International Rail and Highway Commission. The study will determine the location, extent, and availability of known and undeveloped resources in Alaska and northwestern Canada which need additional or improved transport facilities for their commercial development.

Among the resources to be considered in the survey are minerals and metals; petroleum, forest and agricultural products; hydroelectric power; fish and wildlife products; and tourism. Prospects for raw material processing at the source to reduce the high cost of transporting bulk materials will also be explored.

David D. Moore, manager of the Institute's department of economics will coordinate the 18-month study. If potential development warrants new or improved rail or highway routes, Battelle will recommend the most feasible routes based on a cost-benefit ratio.

* Recent appointments of Battelle staff members to key technical posts include: PAUL D. FROST—member, Committee on Titanium and Reactive Metals and Committee on Sand Casting, Light Metals Division, American Foundrymen's Society; JOHN D. SULLIVAN—member, Advisory Committee, Division of Materials Sciences, American Society for Testing Materials; B. D. THOMAS—chairman, Chemistry Section, Research Division, American Ordnance Association.

* *Newly appointed*: Dr. Duane N. Sunderman, chief of Battelle's radioisotopes and radiation division, who will guide the operation of the Institute's radioisotope laboratory and its gamma-irradiation facility.

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AERONAUTICAL ENGINEERING

8594 Hydro-Fatigue Test of a Large Cargo Aircraft. ***J. E. York.*** *Aero/Space Engineering*, v. 18, May 1959, p. 44 + 4 pages.

8595* Hydraulic Missile-Components. Deals with three development goals in missile hydraulics: reduced size and weight, extended temperature operation, and improved reliability. ***Arthur B. Billett.*** *Aircraft and Missiles Manufacturing*, v. 2, May 1959, p. 6-8.

8596* Limitations in Design Evaluation. Inability of test equipment to simulate all high-speed environments puts question mark on some preflight data. ***Armin Bruining.*** *Aircraft and Missiles Manufacturing*, v. 2, May 1959, p. 16-18.

8597* Hunting Jet Provost Profile. All-metal, serviceable basic trainer, presently entering RAF service, is to be used in a two-stage, all-jet flight-training program. Its design centers upon simple, yet rugged systems, paralleling those on operational aircraft. Two side-by-side ejection seats are provided with good visibility over the stubby nose section. Including the wing-tip tanks, a total of eight fuel cells are used, giving the aircraft a capacity of 236 imperial gallons. This allows a flight endurance of about 2½ hours. It is powered by the Armstrong Siddeley Viper turbine which develops a 1750-lb static thrust at 13,800 rpm. Although the Provost is capable of speeds up to Mach 0.8, it is designed to give good performance also at about 200 mph. ***Ronald A. Cole.*** *Aircraft and Missiles Manufacturing*, v. 2, May 1959, p. 48-52.

8598 Structural Flexibility and Undercarriage Impact Loads. The calculation of undercarriage landing reactions and dynamic stresses is discussed, and the merging of the two calculations under certain circumstances is proposed. A formulation of the combined problem is outlined, and numerical examination of a simple case shows that in some cases the reaction forces are appreciably reduced by the adoption of the combined approach. Finally, a criterion is derived which could be used in the early stages of undercarriage design to predict the effect of aircraft flexibility. ***H. R. Alexander.*** *Aircraft Engineering*, v. 31, May 1959, p. 126-130.

8599 The Analysis of Fuselages of Arbitrary Cross-Section and Taper. The flexibility matrices for the unassembled structural elements are discussed and a more concise form developed appropriate to the fuselage structure. A general method is given for obtaining self-equilibrating flange load and shear flow systems in a single-cell fuselage, the primary redundancies being defined by a simple transformation matrix. The particular matrix based on the orthogonal stress systems for a circular section is especially convenient. A slight extension of the equations leads also to alternative statistically equivalent stress systems in the cover. ***J. H. Argyris and S. Kelsey.*** *Aircraft Engineering*, v. 31, May 1959, p. 133-140.

8600 VIIIth International Astronautical Congress, Barcelona, 1957. Forty papers on orbital vehicles and space navigation. ***F. Hecht, editor.*** 607 pp. 1958. Springer-Verlag, Vienna. (TL787 In8p)

8601 The Challenge of Space. A brief survey of today's thinking on the techniques and equipment necessary for propulsion, communication, navigation, and guidance, and power generation in space flight. ***Haig A. Manoogian.*** *Electronics*, v. 32, no. 17, Apr. 24, 1959, p. 65-80.

8602 Guided Missile Engineering. Eighteen contributors encompass a wide range of guided missile engineering, from important details of component structure and design to overall considerations in the development of a missile system. Theoretical and practical material includes electronics, guidance theory, aerodynamics, airframe performance, radio and radar, and computer systems. ***Allen E. Puckett and Simon Ramo, editors.*** 497 pp. 1959. McGraw-Hill, New York. (UG630 P96g)

8603 Helicopters and Autogyros of the World. ***Paul Lambermont and Anthony Pirie.*** 255 pp. + 64 plates. 1959. Philosophical Library, New York. (TL714 L17h)

8604 High Altitude and Satellite Rockets. The 12 papers in this Proceedings, by British and American authors, deal with some of the design and propulsion problems of high altitude rockets, recovery after re-entry, high temperature materials, instrumentation, telemetry and guidance, and some of the human problems of flight beyond the atmosphere. 136 pp. 1958. The Royal Aeronautical Society and the British Interplanetary Society, London. (TL780 Sy68h Over.)

8605 Thermal Analysis of Stagnation Regions With Emphasis on Heat-Sustaining Nose Shapes at Hypersonic Speeds. For either steady-state or transient conditions, the temperature at the leading edge is reduced by conduction, while the temperature aft of the leading-edge shoulder is increased, thus setting up a heat transmission balance between the convective influx of heat, the redistribution of heat by conduction, and the radiation of heat from the surface. The feasibility of such a mechanism can be enhanced by suitably choosing leading-edge shapes and materials. The philosophy behind the choice of leading-edge shapes is discussed and the effects of varying parameters, such as shape, diameter, emissivity, conductivity, thickness, etc., are shown. ***A. J. Hanawalt, A. H. Blessing, and C. M. Schmidt.*** *Journal of the Aero/Space Sciences,* v. 26, May 1959, p. 257-263.

8606 Note on a Criterion for Severity of Roll-Induced Instability. A method is presented which may be used to evaluate the severity of the roll-induced instability inherent in many current aircraft designs. The analysis is based on the assumption of a steady rolling velocity, and for this case, expressions are presented from which the divergence rates can be estimated. Also, from knowledge of the divergence rates, the magnitude of the divergence may be estimated as a function of the angle through which the aircraft is rolled. ***Ordway B. Gates and Karlis Minka.*** *Journal of the Aero/Space Sciences,* v. 26, May 1959, p. 287-290.

8607 Flight Mechanics of Low-Thrust Spacecraft. ***Frank M. Perkins.*** *Journal of the Aero/Space Sciences,* v. 26, May 1959, p. 291-297.

8608 The Problem of Obtaining High Lift-Drag Ratios at Supersonic Speeds. Deals with the maximum lift-drag ratio problem for conventional configurations having a wing and a body in close proximity to each other. ***Clinton E. Brown and Francis E. McLean.*** *Journal of the Aero/Space Sciences,* v. 26, May 1959, p. 298-302.

8609 Modern Airmanship. What the airman needs to know about weather, aerodynamics, the structure and propulsion of his craft, the instruments and tactics of flight, instrument flying and air navigation. Includes new developments in high-performance, supersonic and jet-engine flying and deals with ground services—the layout of airports, the routines of airplane servicing, and the official organizations that control air traffic and administer flying. ***Neil D. Van Sickle, editor.*** 862 pp. 1957. D. Van Nostrand Co., Inc., New York. (TL545 V36m)

8610* Challenge of Space. The Soviets gained a head start in the race only because the U. S. was interested in military missiles of limited range rather than in superpowerful rocket engines that could launch a satellite. ***Wernher von Braun.*** *Ordnance,* v. 43, May-June 1959, p. 901-905.

8611 Aerodynamics for Space Flight. The state-of-the-art of hypersonic aerodynamics is reviewed. Special attention is given to the problem of aerodynamic heating, particularly as it affects hypersonic flight vehicles. ***E. P. Williams and Carl Gazley, Jr.*** *Rand Corporation, Report P-1256,* Feb. 24, 1958, 26 pp. (T13 R15r Contin.)

8612 Researchers Explore Exotic Gyros. Use of gyromagnetic properties of electrons and nucleons for rate and displacement sensing. Possibilities of the particle gyro. ***James Holahan.*** *Space/Aeronautics,* v. 31, no. 5, May 1959, p. 130 + 3 pages.

8613 Space Weapons. Describes the space vehicles now in production and those in various planning stages. Human and other aspects of manned rockets. ***John F. Loosbrock, editor.*** 245 pp. 1959. Frederick A. Praeger, Inc., New York. (UG633 Ai71s)

8614 Commercial Turbine Aircraft Type 152. Brief description of the aircraft. (*In German.*) Turbinen-Verkehrsflugzeug Typ 152. *Technik,* 1959, no. 3, p. 131-132.

8615 3rd Symposium on High-Speed Aerodynamics and Structures. Unclassified papers presented at Symposium held at San Diego, Mar. 25-27, 1958, jointly sponsored by U. S. Air Force and several civilian research organizations. v. I., II., III. 432, 476, and 311 pp., 1958. Convair, San Diego. (TL573 Sy68 Over.)

See also: **8964** (data collection from ballistic missiles); **8973** (computer applications in satellite design); **8989** (aircraft electrical systems); **9039** (missile trajectories from radar observations); **9143** (contamination by extra-terrestrial exploration); **9168** (turbojet engines for subsonic transports); **9171** (Mach 4 turbine engines); **9190** (energy for space vehicles).

AGRICULTURE

8616* Biological Control of Noxious Insects, Weeds. ***C. H. Hoffman.*** *Agricultural Chemicals,* v. 14, Apr. 1959, p. 33 + 2 pages.

8617 Developments in Pelleting Forage Crops. A review of feeding-trial results, stability of forage pellets, development of pelleting machinery. ***H. D. Bruhn, Arnold Zimmerman, and R. P. Niedermeier.*** *Agricultural Engineering,* v. 40, Apr. 1959, p. 204-207.

8618* Auxins. Auxin-regulated cell growth, biochemistry of natural auxins, synthetic auxins, and applications in agriculture. ***J. Van Overbeek.*** *Botanical Review,* v. 25, no. 2, Apr.-June 1959, p. 269-350.

8619* The Production by *Bacillus thuringiensis* Berliner of a Heat-Stable Substance Toxic for Insects. ***Ellicott McConnell and A. Glenn Richards.*** *Canadian Journal of Microbiology,* v. 5, no. 2, Apr. 1959, p. 161-168.

8620* Fungicide Development. Discusses current trend toward specificity in fungicides. ***J. D. Wilson.*** *Farm Chemicals,* v. 122, Mar. 1959, p. 40 + 1 page.

8621* Labelling of Adults of an Insect Parasite *Bracon gelechiae* Ashmead With Radioactive Phosphorus (P^{32}). ***E. S. Narayanan, et al.*** *Indian Academy of Sciences, Proceedings,* v. 49, sec. B, no. 3, Mar. 1959, p. 149-155.

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8623 Bacteria vs. Insects. Reviews recent commercial development of bacterial insecticides based on *Bacillus thuringiensis. Journal of Agricultural and Food Chemistry,* v. 7, May 1959, p. 302 + 1 page.

8624* A Comparison of the Toxicity of Various Insecticides to the Spruce Budworm. Laboratory tests are described in which BHC with and without an extender, aldrin, dieldrin, and endrin were compared with DDT in their effectiveness. In every test DDT was superior. ***J. P. Secrest and Dorothy G. Thornton.*** *Journal of Economic Entomology,* v. 52, no. 2, Apr. 1959, p. 212-214.

8625* Insecticide Resistance in Seven Orlando House Fly Colonies. Laboratory colonies of resistant house flies are described. One has more than 500-fold resistance to DDT. Another resistant colony has 40-fold resistance to lindane, immunity to dieldrin, and 60-100 fold resistance to DDT. ***H. G. Wilson, G. C. LaBrecque, J. B. Gahan, and Carroll N. Smith.*** *Journal of Economic Entomology,* v. 52, no. 2, Apr. 1959, p. 308-310.

8626* Common Names of Insecticides. A revised list compiled by the Committee on Insecticide Terminology of the Entomological Society of America. It supersedes the list issued

in Apr. 1957. ***Carroll N. Smith.*** *Journal of Economic Entomology*, v. 52, no. 2, Apr. 1959, p. 361-362.

8627 Antimicrobial Substances From Resistant and Non-Resistant Seeds. Extracts from cabbage seeds indicate that resistant cabbage seeds possess greater amounts of antimicrobial substances than do non-resistant seeds. ***Jasper C. Maruzzella and Martin Freundlich.*** *Nature*, v. 183, Apr. 4, 1959, p. 972-973.

8628 Genetic Control of Chromosome Pairing in Intergeneric Hybrids With Wheat. ***Ralph Riley, Victor Chapman, and Gordon Kimber.*** *Nature*, v. 183, May 2, 1959, p. 1244-1246.

8629* Viruses in Tissue Culture. I. Plant Viruses in Tissue Culture. II. Tissue Culture for Arthropod Viruses. Isolated roots and plant tissues in culture with tobacco mosaic virus were infected; the growth of infected and noninfected tissues was compared. The usefulness of this procedure was demonstrated in testing chemotherapeutic agents. The successful inoculation of submerged cultures with and without the use of quartz powder was described and the low efficiency emphasized. I. ***L. Bergmann.*** II. ***Thomas D. C. Grace.*** *New York Academy of Sciences, Transactions*, v. 21, no. 3, Jan. 1959, p. 227-241.

8630* The Biochemistry of Humus Formation and Some Problems of Plant Nutrition. ***M. M. Kononova and I. V. Aleksandrova.*** *Soils and Fertilizers*, v. 22, no. 2, Apr. 1959, p. 77-83 + 1 plate.

See also: **8646** (insect immunity to bacterial antigens); **8650** (industrial fungicides); **9733** (wildlife losses from insecticides); **9734** (biological control of insects).

BIOCHEMISTRY AND BIOPHYSICS

8631* On the Problem of Restitution of Integral Muscles From Transplanted Minced Tissue Under Conditions of Their Total Removal in Rats. Observations showed that the skeletal muscles in rats possess a high regenerative capacity, that attributing the restitution of the muscle obtained from a transplanted muscular tissue to a "vital substance" released by it does not correspond to the facts. The suggestion to use the minced muscular tissue in surgery is still premature and requires further investigation. (*In Russian.*) K voprosu o vosstanovlenii tselykh muskulov iz peresazhennoĭ izmel'chennoĭ myshechnoĭ tkani pri ikh total'nom udalenii u krysy. ***G. M. Litver and N. N. Dampel'.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 1, Mar. 1, 1959, p. 232-235.

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8636 Bacteriophages. A comprehensive text on bacteriophages with individual chapter on the infective process, enumeration, size and morphology, effects of physical and chemical agents, effects of radiations, chemical composition, antigenic properties, host specificity, adsorption, phage multiplication, nutritional and metabolic requirements, chemical interference with phage growth, mutation and phenotypic variation, mixed infection, genetics, lysogeny, colicins and other bacteriocins, and taxonomy. ***Mark H. Adams.*** 592 pp. 1959. Interscience Publishers, New York. (QR185.B4 Ad19b)

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8639* Similarity in Mode of Action of Chloramphenicol and Erythromycin. Erythromycin, too, stops protein synthesis in bacteria, while having little effect on synthesis of nucleic acids. Mixtures of the two antibiotics give an exactly additive response. ***Thomas D. Brock and M. L. Brock.*** *Biochimica et Biophysica Acta*, v. 33, no. 1, May 1959, p. 274-275.

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8659* The Somatic Chromosomes in Mongolism. In six cases the diploid number was found to be 47: the additional chromosome is an acrocentric chromosome in the smallest size range, where the Y chromosome is also to be found. ***Patricia A. Jacobs, A. G. Baikie, W. M. Court Brown, and J. A. Strong.*** *Lancet,* v. 1, Apr. 4, 1959, p. 710.

8660* A Sex-Chromosome Anomaly in a Case of Gonadal Dysgenesis (Turner's Syndrome). Chromosomes were counted in 102 cells of which 99 cells were found to have 45 chromosomes only. In 14 cells which were selected for detailed study, 4 small acrocentric chromosomes were present, as in a normal female; in a normal male there are 5 of these chromosomes, one being the Y chromosome. All the selected cells also contained 15 medium-length metacentric chromosomes, as in a normal male—a normal female having 16 which include the two X chromosomes. These observations of themselves strongly suggest that the chromosome constitution is XO. ***C. E. Ford, et al.*** *Lancet,* v. 1, Apr. 4, 1959, p. 711-713.

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8664 Some Effects of Colchicine on Lampbrush Chromosomes. Colchicine caused no disruption in the linear integrity of the chromosomes, but there was a complete absence of loops along the entire length of the chromosomes except for the giant loops which remained. ***A. P. Amarose.*** *Nature,* v. 183, Apr. 4, 1959, p. 975-976.

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8668 Infectious Ribonucleic Acid as Precursor of Tobacco Mosaic Virus. ***Reto Engler and Gerhard Schramm.*** *Nature,* v. 183, May 2, 1959, p. 1277-1279.

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Henry Quastler and Marion Zucker. *Radiation Research*, v. 10, no. 4, Apr. 1959, p. 402-409.

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8690* The Effect of Herpes Virus on HeLa Cells Dividing Parasynchronously. Mitosis of the HeLa cells is inhibited, and this inhibition is prevented by serum containing virus neutralizing antibody. The damage to mitosis occurs rapidly relative to the cycle of virus growth, probably less than 1 hour after virus adsorption. Virus particles which absorb to, but do not infect, the HeLa cells, fail to inhibit mitosis. ***M. G. P. Stoker and Alison Newton.*** *Virology*, v. 7, no. 4, Apr. 1959, p. 438-448.

8691* The Internal Structure of Influenza Virus. Based on physical, chemical and serological investigations, a model is proposed for the inner structure of influenza virus. It agrees with the electron microscope image. ***W. Frisch-Niggemeyer.*** *Zeitschrift für Naturforschung*, v. 14b, Mar. 1959, p. 168-171.

See also: **8901** (surface phenomena).

CERAMICS AND CONCRETE

8692* Experiments in Extrusion. Flow of clay in a fully instrumented experimental extruder, which gave continuous readings of thrust, torque and rate of extrusion. ***F. J. Goodson.*** *British Ceramic Society, Transactions*, v. 58, Mar. 1959, p. 158-187.

8693 Factors Influencing the Selection of Ceramic Insulation. Guide to selecting electric insulators. Consulting work; materials available; resistivity vs temperature; ceramic- and glass-to-metal seals; design considerations. ***R. R. Van Der Beck.*** *Ceramic Age*, v. 73, no. 4, Apr. 1959, p. 47-51.

8694 Thermoelectricity. Uses and applications of thermoelectric devices and their importance to the ceramic industry. ***F. N. Bradley.*** *Ceramic Age*, v. 73, no. 4, Apr. 1959, p. 52-53.

8695 Ceramic-Metal Bonding. Studies suggest that the mechanism of ceramic-metal bonding involves a chemical process rather than mechanical interlocking. The investigation showed that gold diffused into the silica lattice at relatively high oxygen and air pressures, but not during vacuum heating. *Ceramic Age*, v. 73, no. 4, Apr. 1959, p. 54-55.

8696 Fiber Stretches Graphite Use. Graphite can now be made in fiber form adding elasticity to its traditional properties. *Chemical Engineering*, v. 66, May 4, 1959, p. 70.

8697 Clays and Clay Minerals. Proceedings of Sixth National Conference; covers crystal structure of clay minerals, alteration of feldspars, clay mineralogy of soils, morphology of clay particles, water vapor sorption, and diageneses. May serve as a reference book in clay mineralogy, ceramics, agronomy, and petroleum engineering. ***Earl Ingerson and Ada Swineford, editors.*** 411 pp. 1959. Pergamon Press, New York. (TN941 N21c)

8698* Some Interesting Properties of Pyrolytic Carbon. I. The Structure and Density of Pyrolytic Carbon. II. Deformation of Deposited Carbon. Results which have been obtained during general studies of carbon and graphite. Experiments on the way in which the graphites laid down at high temperatures (2100-2200 C) deform when under three-point loading; the load was applied parallel to the c-axis. I. ***A. R. G. Brown, D. Clark, and J. Eastabrook.*** II. ***F. J. Bradshaw and C. Wheeler.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 94-105.

8699* The High Temperature Stability of Oxides and Sulphides. The metal oxides include some of the most stable chemical compounds known and many have very high melting points. Barium oxide also has a large free energy of formation but there is a further rise in thermodynamic stability in the oxides of the rare earths, although values for some of these are not known. The oxides of the actinide group metals are also very stable. The properties of a number of refractory sulfides are shown together with the heat of formation of the corresponding oxide. ***D. T. Livey.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 145-151.

8700* Construction of Prestressed Concrete Pavement Slabs in Osaka City. Describes slabs 60 m. and 40 m. in length. Prestressing steel was laid in both longitudinally and transversely in the 60 m. slab, and diagonally with angles of intersection of about 60 deg. in the 40 m. slab. Test results prove the superior behavior of prestressed slabs, especially in their elastic recovery, and indicate that such construction could be advantageously utilized in future pavement construction when it becomes economically comparable with other forms of construction. ***Yasuo Kondo and Kiyoshi Okada.*** *Kyoto University, Memoirs of the Faculty of Engineering*, v. 21, pt. 1, Jan. 1959, p. 1-14.

8701 Mechanical Properties of Non-Metallic Brittle Materials. Consists of 27 papers on rocks, ceramic materials, coal, and concrete. Includes a section on coal tool design. ***W. H. Walton, editor.*** 492 pp. 1958. Interscience Publishers, Inc., New York. (TA405 C76m)

8702 A Rapid Method for Comparing Subsieve Fineness of Milled Porcelain Enamel. The method involves a short-term settling test. It might be described best as a combination of a modified Andreason pipette and a modified hydrometer method. ***E. E. Bryant and Gordon H. Johnson.*** *Metal Products Manufacturing*, v. 16, May 1959, p. 70-72.

8703* Artificial Silicon Carbide and Electrocorundum Abrasives. Preparation; properties; applications; costs; outlook. (*In German.*) Künstliche Schleifwerkstoffe Siliziumkarbid und Elektrokorund. ***A. Schneider.*** *Radex Rundschau*, 1959, no. 1, Jan., p. 421-433.

8704* The Role of Refractories in an Expanding Technology. Historical development of refractories; raw materials used in manufacturing; uses of refractories; modes of failure. ***J. White.*** *Refractories Journal*, v. 35, Mar. 1959, p. 104-114.

8705* Recent Work on Chrome-Magnesite Bricks. Tools and apparatus for research; volume stability at 1800 C; changes occurring during firing. ***J. Laming and F. I. Ceram.*** *Refractories Journal*, v. 35, Mar. 1959, p. 116-118.

8706* Russia Gets World's Largest Cement Kilns. Siberian plant to burn unique nepheline mix; makes 12½ million bbl. a year. ***Jean M. A. Comte.*** *Rock Products*, v. 62, May 1959, p. 128-131.

8707 Surface Cracks on Glass. By employing a ball indenter in conjunction with vapor etching, it was possible to determine with greater accuracy the real nature of the surface cracks that were developed. It was established that the surface stressing action of the Na vapor not only dilates the existing cracks, but also forms additional extensive networks. Furthermore, the ball indenter is capable of distinguishing the real from the artificial cracks. Glasses other than chemical Pyrex were found resistant to etching. ***A. S. Argon.*** *Royal Society, Proceedings*, v. 250, ser. A, Apr. 7, 1959, p. 472-481 + 1 plate.

8708* The Thermal Behavior of Kaolin and of Argillaceous Materials. Kaolin loses adsorbed water below 400 C; from 400 to 800 C kaolinite dehydrates; from 800 to 950 C the kaolin network structure breaks down; around 950 C γ alumina is formed; and from 950 C up, the following are formed in succession: χAl_2O_3, ΘAl_2O_3, mullite + amorphous silica, mullite + cristobalite, and mullite crystals. (*In French.*) Le comportement thermique du Kaolin et des matériaux argileux. ***W. L. DeKeyser.*** *Silicates Industriels*, v. 24, no. 4, Apr. 1959, p. 190-196.

8709* Some Investigations Concerning Metallurgical Cements. Effect of separate or simultaneous crushing of clinker and slag on quality of cements; influence exerted by different grinding of constituents on strength of concrete. (*In French.*) Quelques Recherches sur les Ciments métallurgiques. ***Robert Stumper.*** *Silicates Industriels*, v. 24, no. 4, Apr. 1959, p. 203-207.

8710 The Structure of Glass. Proceedings of a conference on the structure of glass held at Leningrad, Nov. 23-27, 1953. Papers cover chemistry and properties of a wide range of glasses. ***Frances Coleman, editor.*** 291 pp. 1958. Consultants Bureau, Inc., New York. (TP848 So89tr) (Translated from Russian by E. B. Uvarov.)

8711 A Survey on Silicon Carbide. Data on crystallographic, material, electrical, optical, and device aspects are collected with preference for information useful to semiconductor personnel. The identity of silicon carbide as an extremely high-temperature semiconductor is established. Miscellaneous observations, such as color forms, their basis in optics and in the energy-band picture, are included. ***M. Minamoto.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-58-363*, Dec. 1958, 46 pp. (TK7800 Un3.12b)

8712 Application of Ultrahigh-Pressure High-Temperature Equipment to Study of UO_2 Reactions. Equipment and techniques for high-pressure high-temperature solid-state studies were developed, and some preliminary results for the reaction of U oxides with other oxides were obtained. A new die design was evolved which appears suitable for any work currently contemplated. The maximum capabilities of this new die are as yet undetermined, but its theoretical pressure limit is in excess of 200,000 atm. The die differs from similar equipment in that internal heating of the sample is employed and maximum pressure and temperature can be maintained simultaneously. ***Wendell B. Wilson.*** *U. S. Atomic Energy Commission, BMI-1328*, Mar. 18, 1959, 34 pp. (UF767 U3b Contin.)

8713 Some Preparation Methods and Physical Characteristics of UO_2 Powders. Methods of preparation of UO_2 powders having a wide range of physical properties are discussed. The effects of chemical and mechanical processes, temperature of preparation, and O/U ratio on the density, surface area, porosity, crystallite size, and particle-size distribution of the UO_2 are determined. The results of a microscopic study reveal that the shape and structure of the UO_2 particles depend upon their method of preparation. ***J. C. Clayton and S. Aronson.*** *U. S. Atomic Energy Commission, WAPD-178*, Dec. 1958, 43 pp. (UF767 Un3.1wa Contin.)

See also: **8738** (drying of gypsum concrete panels); **8820** (graphite).

CHEMICAL ENGINEERING

8714* Progress in Perfumery Materials. II. A review with 87 references. ***Paul Z. Bedoukian.*** *American Perfumer and Aromatics*, v. 73, Apr. 1959, p. 54-56.

8715* Industrial Soaps: What Can Be Done With Soaps to Meet the Challenge of Detergents. ***Warner M. Linfield.*** *American Perfumer and Aromatics,* v. 73, Apr. 1959, p. 59-60.

8716* Electrostatic Interaction Between Oppositely Charged Ion Exchanger Particles. Oppositely charged ion exchangers may electrostatically attract each other, causing lumping and swelling of the resin mixture. It is shown under what conditions this attraction occurs. Slight additions of very finely ground ion exchangers are especially effective for suppressing it. (*In German.*) Elektrostatische Wechselwirkung zwischen gegensinnig geladenen Ionenaustauscher-Teilchen. ***N. Grubhofer.*** *Angewandte Chemie,* v. 71, no. 6, Mar. 21, 1959, p. 215-217.

8717* The Influence of Monolayers on Evaporation From Water Storages. II. Evaporation and Seepage From Water Storages. III. The Action of Wind, Wave, and Dust Upon Monolayers. ***W. W. Mansfield.*** *Australian Journal of Applied Science,* v. 10, no. 1, Mar. 1959, p. 65-84.

8718* Iron Castings in the Chemical Industry. Description of some of the castings which are peculiar to the chemical industry, of a shape which are not likely to be found elsewhere. ***G. A. J. Begg.*** *British Foundryman,* v. 52, Apr. 1959, p. 183-193.

8719 Water Vapor Permeability of Porous Media. Two theoretical expressions for the thermal conductivity of a composite medium are applied to the water vapor permeability coefficient of certain porous media. It is shown that both expressions reduce to a form very similar to the empirical relationships found by Penman and Edenholm for soils, glass spheres, charcoal, and cellular concrete. ***William Woodside.*** *Canadian Journal of Physics,* v. 37, Apr. 1959, p. 413-416.

8720* Calculation of the Extraction and Adsorption of Phenols From Aqueous Solutions. (*In French.*) Calcul pour l'extraction et l'adsorption des phénols de solutions aqueuses. ***A. Dierichs and L. Jaehn.*** *Centre Belge d'Etude et de Documentation des Eaux, Bulletin No.* 43, 1959, p. 6-13.

8721* Effects of Synthetic Detergents Upon the Aeration Process. Depends upon the method of stirring the liquid, and the concentration of the detergents and other substances present. (*In French.*) Les effets des détergents synthétiques sur les processus d'aération. ***A. L. Downing.*** *Centre Belge d'Etude et de Documentation des Eaux, Bulletin No.* 43, 1959, p. 24-31.

8722* Experimental Vinyl Monomers From Gas Mixtures of Low Acetylene Content. Review of laboratory- and pilot-scale production of vinyl monomers from gas mixtures of low acetylene content in Hungary. *Chemical Age,* v. 81, Apr. 11, 1959, p. 617.

8723 Zone Refining Excites Hopes for Purity Gain. Now used widely for purifying semi-conductors, zone refining captures the imagination of chemical people; may lead to new product-purity levels. *Chemical Engineering,* v. 66, Apr. 20, 1959, p. 80-82.

8724 High Temperature Chlorination in a Fluidized Bed. Temperature control proves critical in extraction of Mg from olivine ore. ***Kermit B. Bengtson and L. N. Johanson.*** *Chemical Engineering Progress,* v. 55, Mar. 1959, p. 49-58.

8725 Air Cooled Heat Exchange. Air vs. water cooling; performance of integral-finned duplex tubes, optimum air fin cooler design. *Chemical Engineering Progress,* v. 55, Apr. 1959, p. 37-48.

8726 Distribution and Storage of Ethylene. The Gulf Oil system for large-scale storage in underground salt domes. ***W. H. Litchfield, et al.*** *Chemical Engineering Progress,* v. 55, Apr. 1959, p. 68-73.

8727* Chemical Pumps. Summarizes the advances made by pump manufacturers in providing the special features necessary for chemical pumping duties and discusses some notable developments as well as some needs which have not yet been met. ***W. F. Riester.*** *Chemical & Process Engineering,* v. 40, Apr. 1959, p. 119 + 4 pages.

8728* Castor Oil, Its Production and Use. A study of *Ricinus communis,* original habitat, present areas of cultivation, seed growth requirements, productions and qualities of castor oil and by-products, preparation of high quality products like undecylenic, sebacinic, linolic acids and Turkey red oil, and applications in the cosmetic, textile and other industries. (*In German.*) Das Rizinusöl, seine Gewinnung und Verwertung. ***Hermann Behncke.*** *Chemiker-Zeitung,* v. 83, no. 7, Apr. 10, 1959, p. 218-223.

8729* Reactions of Solids in Fluidized Beds of Pelletized Solids. (*In German.*) Festkörperreaktionen in Wirbelschichten aus verpillten Festkörpern. ***Tibor Blickle.*** *Chemische Technik,* v. 11, no. 3, Mar. 1959, p. 131-134.

8730* Treatment of Industrial Waste Waters by Ion Exchangers. Description of an installation for eliminating metallic impurities of a plant in Bournemouth, England. (*In German.*) Behandlung von Industrieabwässern mit Ionenaustauschern. ***Georg H. Osborn.*** *Chemische Technik,* v. 11, no. 3, Mar. 1959, p. 144-146.

8731 Surface-Active Substances in Food Processing: Some Biochemical and Pharmacological Aspects. Outlines difficulties in the assessment of hazards arising from use of surfactants. ***Francis Aylward.*** *Chemistry & Industry,* 1959, no. 17, Apr. 25, p. 524-531.

8732* Production of Carbon Disulphide From Methane and Sulphur Dioxide. Production of CS_2 by reacting CH_4 and SO_2 at 700-800 C on metal oxide catalysts. (*In Italian.*) Produzione di solfuro di carbonio da metano e anidride solforosa. ***M. Baccaredda, M. Del Guerra, and G. F. Nencetti.*** *Chimica e l'Industria,* v. 41, Apr. 1959, p. 277-280.

8733* Extraction of Hydrogen Sulfide From Gas by Means of Ammonia Water. I. Scrubbing Hydrogen Sulfide Out of the Gas. (*In German.*) Gewinnung von Schwefelwasserstoff aus dem Gas mit Hilfe von Ammoniakwasser. I. Das Auswaschen des Schwefelwasserstoffs aus dem Gas. ***Fritz Rosendahl.*** *GWF: Gas- und Wasserfach,* v. 100, no. 11, Mar. 13, 1959, p. 263-267.

8734* Studies on Sea Water Refrigeration Concentration. XI. Deliming of Freeze Concentrated Sea Brine by MgO and CO_2. The influences of the quantity of the added MgO, the reaction temperature, and the partial pressure of CO_2 and the like on the dissolution of the suspended MgO in freeze-concentrated sea brine by inflowing CO_2 and on the consequent inoic constitution of the solution were observed. (*In Japanese.*) ***Takashi Uchida.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 54, Feb. 1959, p. 48-66.

8735 Designing for Maintenance. Ideas that can be "borrowed" which will reduce maintenance costs. *Industrial and Engineering Chemistry,* v. 51, Apr. 1959, p. 46A-50A.

8736 The Schultz Steam-Iron Process. Describes the modern steam-iron process for the production of H and comparative cost data. ***P. V. Clifton.*** *Industrial Chemist,* v. 35, Apr. 1959, p. 161-166.

8737 Transporting Liquefied Methane. Ways and means to import natural gas in its cold liquid state. ***Charles I. Kelly.*** *Institute of Petroleum Review,* v. 13, Apr. 1959, p. 106-112.

8738* The Drying of Gypsum Concrete Panels. Theory and practice show that it is possible to introduce more rigid stages of drying without danger of cracks or overheating of the material above the admissible limit. When working on the proposed accelerated schedule ($t_1 = 129$ C, $v_2 = 2.1$ m/sec.), the duration of the process of drying gypsum concrete panels is reduced from 35 to 20-24 hours, thus increasing the productivity of drying establishments by 50%. (*In Russian.*) K voprosu o sushke gipsobetonnykh panelei. ***T. F. Tagantseva.*** *Inzhenerno-Fizicheskiĭ Zhurnal,* v. 2, no. 4, Apr. 1959, p. 15-20.

8739* 'Flash' Distillation Plant. Description of the English "Aquaflash" plant for distilling seawater. *Machinery Lloyd (Overseas Ed.),* v. 31, no. 9, Apr. 25, 1959, p. 74-75.

8740* Pharmaceutical Dispersions of Solids in Liquids. Some principles which have been found in practice to be important in formulating pharmaceutical suspensions. ***David Jack.*** *Manufacturing Chemist,* v. 30, Apr. 1959, p. 151-153.

8741 Stripper-Stabilizer Problems Yield to Digital Computers. A program developed to give fast, accurate solutions to multicomponent fractionation problems. Program was worked up specifically for work on cold-feed stabilizers. But this approach has other applications, such as strippers which involve rectification and rich-oil deethanizers which involve absorption and stripping. ***C. R. McNeese.*** *Oil and Gas Journal,* v. 57, no. 18, Apr. 27, 1959, p. 106-111.

8742 This Computer Program Handles Wide Composition Range. A plate-to-plate computer program which is available to the public at large has been developed at Oklahoma State University. It's designed for IBM 650 but can be adapted for nearly any medium-sized computer. ***R. N. Maddox and J. H. Erbar.*** *Oil and Gas Journal,* v. 57, no. 18, Apr. 27, 1959, p. 116-119.

8743 Air-Cooled Heat Exchangers. Special report discussing cost comparisons for some typical air-cooling uses, a check list for specifying the equipment to a vendor, some pointers for design, and useful tips on how to field test air-cooler installations. *Petroleum Refiner,* v. 38, Apr. 1959, p. 99-118.

8744 New Processes Remove *n*-Paraffins. II. The Molex Process. ***D. B. Carson and D. B. Broughton.*** *Petroleum Refiner,* v. 38, Apr. 1959, p. 130-134.

8745 How to Design Tank Heating Coils. Formulas with experimental data, for calculating heat losses, coil area, and a discussion of factors which affect coil layout and location. ***David Stuhlbarg.*** *Petroleum Refiner,* v. 38, Apr. 1959, p. 143-150.

8746 Heat Transfer Nomographs. VII. Heat Transfer Coefficients for Liquids and Gases Inside Tubes. ***Jose Alvarez C. and Carlos Duhne.*** *Petroleum Refiner,* v. 38, Apr. 1959, p. 157-158.

8747 Applied Hydrocarbon Thermodynamics. X-A. Charts for Making Compressor Calculations. ***Wayne C. Edmister.*** *Petroleum Refiner,* v. 38, Apr. 1959, p. 161-167.

8748* The Fe-Cr Catalyst in a Fluidised Bed for Conversion of Carbon Monoxide With Water Vapour. II. (*In Polish.*) Katalizator Fe-Cr w stanie fluidalnym do konwersji tlenku węgla z para wodna, cz. II. ***Antoni Jastat, Konrad Janio, and Zbigniew Gorzka.*** *Przemysł Chemiczny,* v. 38, no. 2, Feb. 1959, p. 93-97.

8749* The Synthesis of Melamine Guanidine-Formaldehyde Anion Exchanger. (*In Polish.*) Synteza anionitu melaminoguanidyno-formaldehydowego. ***Feliks Polak and Barbara Kubiak-Bem.*** *Przemysł Chemiczny,* v. 38, no. 2, Feb. 1959, p. 107-110.

8750* Theoretical Investigation of Heat and Substance Exchange Processes During Calcining. (*In German.*) Theoretische Untersuchung der Wärme- und Stoffaustauschvorgänge beim Kalkbrennen. ***Géza Balázsovics.*** *Radex Rundschau,* 1959, no. 1, Jan., p. 434-454.

8751 The High-Temperature Oxidation of Propane. Above 400 C propane is oxidized by a two-stage degenerately branching chain reaction. The first 20% of reaction proceeds by an HO_2/C_3H_7 radical chain where the main immediate products are propylene and H_2O_2. Pyrolysis of a small fraction of the propyl radicals gives rise to methyl radicals and finally formaldehyde. The further oxidation of formaldehyde by molecular O probably accounts for the observed chain branching although at temperatures above 475 C homogeneous decomposition of H_2O_2 may lead to the initiation of new chains. ***J. W. Falconer and J. H. Knox.*** *Royal Society, Proceedings,* v. 250, ser. A, Apr. 7, 1959, p. 493-513.

8752* Tidewater's Delaware Refinery Waste Control and Treatment. I. Facilities and Treatment Methods. II. Evaluation of Treatment Methods. I. ***A. W. Lewis.*** II. ***A. Joel Kaplovsky.*** *Sewage and Industrial Wastes,* v. 31, Apr. 1959, p. 424-442.

8753* Organization for Liquid Waste Control in General Motors Corporation. ***David Milne.*** *Sewage and Industrial Wastes,* v. 31, Apr. 1959, p. 447-457.

8754 Pressure Losses in Fittings. Results of measurements covering all the current types of fittings carried out by the Research Laboratory for Industrial Fittings. (*In Czech.*) Ztráty tlaku v armaturách. *Strojírenství,* v. 9, no. 3, Mar. 1959, p. 163-169.

8755 Self-Priming Centrifugal Pumps. Deals with the development of the Sigma self-priming pumps. Experimental pumps and pumps in series production are considered. Various modifications derived from the basic type and designed for food industries are discussed. (*In Czech.*) Příklady konstrukcí samonasávacích rotačních čerpadel. ***J. Bundil.*** *Strojírenství,* v. 9, no. 3, Mar. 1959, p. 207-211.

8756* The Dry-Piston Compressor for Handling Gases and Vapours Without Oil Contamination. Reviews origins, method of operation and applications of the Sulzer oil-free compressor. ***U. Ritter.*** *Sulzer Technical Review,* v. 40, no. 2, 1958, p. 3-16.

8757 Turbine Contactor for Solvent Extraction. Test of a liquid-liquid contactor of commercial size showed that its performance was predictable on the basis of data previously obtained with a laboratory contactor having one-fiftieth the volume. The criterion for composite performance of the mixer and settler was the heat conductance achieved at a given dispersion depth. ***G. Starr Nichols.*** *U. S. Atomic Energy Commission, DP-*255, Dec. 1958, 24 pp. (UF767 Un3.1dp Contin.)

8758 Anomalous Extraction of Zirconium, Niobium, and Ruthenium by Tributyl Phosphate. The abnormally high extraction, even when nearly saturated with uranyl nitrate, is attributed to the presence of an organophilic carrier that is present in the initial nitric acid solutions of irradiated U. The carrier remains in the organic phase making the desorption of these fission products from the organic phase a very slow process. Some evidence indicated that the carrier may be hydrated silica. Extraction of Zr, Nb, and Ru by TBP was reduced greatly by adding macroamounts of Nb compounds to the feed and precipitating Nb_2O_5 prior to solvent extraction. ***Richard M. Wallace and Henry Pollock.*** *U. S. Atomic Energy Commission, DP-*308, Sept. 1958, 25 pp. (UF767 Un3.1dp Contin.)

8759 Bubbling From Perforated Plates. A 6-inch-square column was used to investigate certain operating characteristics of perforated plates. The amplitude and frequency of the pressure fluctuations in the chamber under the plates were studied. The time-average pressure drop across a plate and dumping rate of liquid through the holes were also investigated. Various gas-liquid systems were used to study the effects of the physical properties of the system. ***Robert S. Brown.*** *U. S. Atomic Energy Commission, UCRL-*8558, Dec. 1958, 142 pp. (UF767 U3u Contin.)

8760 Developments in Porous Metal Media for Gas Filtration. The design and development of high strength, low pressure drop, corrosion resistant metal elements with superior blow-back properties for gas filtration in several applications are described. Performance characteristics of the new media are compared with that of several commercial items. ***R. P. Levey, Jr.*** *U. S. Atomic Energy Commission,* Y-1235, Apr. 7, 1959, 26 pp. (UF767 Un3.1y Contin.)

8761* The New Coefficient Data for Feed and Boiler Water. Data on water for water-tube boilers with natural and controlled circulation and forced-flow boilers. (*In German.*) Die neuen Richtwerte für Speise- und Kesselwasser. ***Kurt Paulik.*** *VDI Zeitschrift,* v. 101, no. 10, Apr. 1, 1959, p. 383-384.

8762* Concerning the Influence of Out-of-Roundness of a Pressure Vessel, of a Cellulose Digester in Particular, on Stresses and Distortions. I. Measurements of actual stresses and deformations produced by out-of-roundness were taken at the State Technical Research Institute in Helsinki. The stress and deformation values measured agreed well with the values computed according to a formula of P. Laasonen. Application of these findings to brick-lined or plated digesters led to proposals for the amendment of tolerances. (*In German.*) Über den Einfluss der Unrundheit eines Druckbehälters, insbesondere eines Zellulosekochers, auf die Spannungen und Formänderungen. I. ***Jaakkima Kilpi.*** *VDI Zeitschrift,* v. 101, no. 11, Apr. 11, 1959, p. 421-429.

See also: **8969** (control equipment); **9063** (European chemical industry); **9076** (selecting hydraulic tubing); **9085** (sound fields and heat transfer); **9086** (flow of bulk solids); **9087** (flow of bulk solids); **9217** (bibliography on hydrocyclones and centrifuges); **9243** (heat transfer); **9256** (alloy steels for pressure vessels); **9257** (high-Ni alloys in refinery equipment); **9619** (U recovery by fused salt-fluoride volatility process).

CHEMISTRY—ANALYTICAL

8763 The Determination of Alkyl Aryl Sulfonates by Ultraviolet Absorption. ***R. M. Kelley, E. W. Blank, W. E. Thompson, and R. Fine.*** *ASTM Bulletin*, no. 237, Apr. 1959, p. 70-73.

8764* Determination of Free Protein Mobilities by Paper Electrophoresis With Evaporation. I. Evaluation of the Buffer Flow Due to Evaporation and Electroosmosis. II. Evaluation of Temperature and Concentration Increases, Influence of the Carrier Medium, and Measurement of Serum Protein Mobilities. I. ***Kurt Schilling and Heinz Waldmann-Meyer.*** II. ***Heinz Waldmann-Meyer and Kurt Schilling.*** *Acta Chemica Scandinavica*, v. 13, no. 1, 1959, p. 1-28.

8765* Simultaneous Microdetermination of Carbon, Hydrogen and Nitrogen in Nitro-Compounds. Description of a gravimetric method applied to nitro-compounds of C, H, N, O, Cl, and Br by combustion in an oxygen current. The accuracy of determination for C and H is ± 0.2%, and for N ± 0.3% (*In Russian.*) Odnovremennoe mikroopredelenie ugleroda, vodoroda i azota v nitro-soedineniiakh. ***V. A. Klimova and K. S. Zabrodina.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1959, no. 4, Apr., p. 582-585.

8766* Analysis of Surfactant Mixtures. I. Data on the use of 93% phosphoric acid as a reagent for recovering the hydrophobic portion of surfactants; their application to the analysis of surfactant mixtures. ***J. D. Knight and R. House.*** *American Oil Chemists' Society, Journal*, v. 36, May 1959, p. 195-200.

8767* The Infra-Red Analysis of Solid Substances. A Review. Physical and chemical factors affecting spectra. ***G. Duyckaerts.*** *Analyst*, v. 84, Apr. 1959, p. 201-214.

8768* The Determination of Copper in Certain High-Alloy Steels. Separation is based on the extraction of copper dithizonate with CCl_4, Cu being finally determined absorptiometrically as its blue bis*cyclo*hexanone oxalyldihydrazone complex. ***C. R. Elliott, P. F. Preston, and J. H. Thompson.*** *Analyst*, v. 84, Apr. 1959, p. 237-239.

8769* A Universal Buffer Solution for Use in Ultra-Violet Spectrophotometry. Replacement of the barbitone component of Britton and Robinson's universal buffer mixture by trishydroxymethylaminomethane allows this buffer to be used for pH control in ultra-violet spectrophotometry. ***M. T. Davies.*** *Analyst*, v. 84, Apr. 1959, p. 248-251.

8770* High Precision Titrimetry. I. An Examination of the Attainable Precision. Re-examination and critical assessment of the mechanical precision of titrimetric processes, with particular reference to the drainage errors of burettes. Manipulative improvements suggested. ***E. Bishop.*** *Analytica Chimica Acta*, v. 20, no. 4, Apr. 1959, p. 315-323.

8771* The Chelometric Determination of Chromium, Cobalt(III) and Copper With a Metalfluorechromic Indicator. Calcein has been applied as a metalfluorechromic indicator for the back titration of relatively large amounts of Co(III), Cr(III), and Cu(II). ***Donald H. Wilkins.*** *Analytica Chimica Acta*, v. 20, no. 4, Apr. 1959, p. 324-325.

8772* Oxidation of Hydroxylamine by Ferricyanide in Presence of Zinc Sulfate. A Rapid Method for Estimating Hydroxylamine and Hydrazine in a Mixture. ***Bharat R. Sant.*** *Analytica Chimica Acta*, v. 20, no. 4, Apr. 1959, p. 371-375.

8773* The Determination of Cobalt, Iron Plus Vanadium or Manganese in Soft Magnetic Alloys. Ion exchange separation. ***Donald H. Wilkins and Louis E. Hibbs, Jr.*** *Analytica Chimica Acta*, v. 20, no. 5, May 1959, p. 427-429.

8774* Simultaneous Spectrophotometric Determination of Traces of Cobalt, Nickel and Copper With N,N'-bis(3-Dimethylaminopropyl)dithio-oxamide. ***William D. Jacobs and John H. Yoe.*** *Analytica Chimica Acta*, v. 20, no. 5, May 1959, p. 435-443.

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8778 Nonferrous Metallurgy. Reviews recent contributions of analytical methods for nonferrous metals; 368 references are covered. ***G. H. Farrah and M. L. Moss.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 713-723.

8779 Properties of Ethyl Esters of Certain Amino Acids as Related to Artifacts in Paper Chromatography. Importance of esters as artifacts in the chromatographic analysis of amino acid solutions and procedures to reduce or prevent their formation. ***James E. DeVay, Albert R. Weinhold, and Gunter Zweig.*** *Analytical Chemistry*, v. 31, May 1959, p. 815-817.

8780 Isolation of Carotenoids, Coumestrol, Chlorogenic Acid, and Antibiotics. Application of countercurrent distribution technique to biologically active materials is reviewed briefly and examples showing its uses are given. ***C. R. Thompson, A. L. Curl, and E. M. Bickoff.*** *Analytical Chemistry*, v. 31, May 1959, p. 838-841.

8781 Automatic Derivative Potentiometric and Spectrophotometric Titrations of Organic Acids. Nonaqueous titrations of carboxylic acids, sulfonamides, imides, mercaptans, phenols, and enols can be performed rapidly and accurately with a single titrant-solvent combination and automatic derivative potentiometric or spectrophotometric end point termination. ***H. V. Malmstadt and D. A. Vassallo.*** *Analytical Chemistry*, v. 31, May 1959, p. 862-865.

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8786 Photometric Determination of Tantalum With Phenylfluorone. Interference of other metals is eliminated by virtually isolating the Ta by solvent extraction from hydrofluoric-hydrochloric acid solution. ***C. L. Luke.*** *Analytical Chemistry*, v. 31, May 1959, p. 904-906.

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8788 Spectrophotometric Determination of Traces of Nickel With 4-Isopropyl-1,2-cyclohexanedionedioxime. ***B. L. McDowell, A. S. Meyer, Jr., R. E. Feathers, Jr., and J. C. White.*** *Analytical Chemistry,* v. 31, May 1959, p. 931-934.

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8790* Newer Analytical Methods in the Technology of Uranium. Determination of small amounts of chloride ion, traces of soluble silicate, sulfate ion, fluoride, and phosphate in U-containing materials. ***K. F. Sporek.*** *Chemistry in Canada,* v. 11, Apr. 1959, p. 66 + 3 pages.

8791* Analytical Applications of Gas Chromatography. I. Analysis of Impurities of Technical Methane. Analytical procedure is described for the determination of small amounts of CO_2, ethane, propane, isobutane, n-butane, and butenes in technical methane, by gas chromatography. (*In Italian.*) Applicazioni analitiche industriali della cromatografia di gas. I. Analisi delle impurezze del metano. ***M. De Vita, G. Caprioli, and E. Pavan.*** *Chimica e l'Industria,* v. 41, Apr. 1959, p. 292-294.

8792* Analysis by Preparatory Gas Chromatography and by Mass Spectrometry of the Heavy Products of Chlorodifluoromethane Pyrolysis. Identification and quantitative determination of the constituents of gaseous mixtures of the heavy products of the pyrolysis of foran 22, CF_2ClH. Possibilities of the technique in studying the effect of impurity traces on the kinetics of certain reactions and in comparing commercial products. (*In French.*) Analyse par chromatographie gazeuse préparative et spectrométrie de masse des produits lourds de la pyrolyse du chlorodifluorométhane. ***J. Serpinet.*** *Chimie Analytique,* v. 41, Apr. 1959, p. 146-151.

8793* Determination of Oxygen in Aluminium by Means of Vacuum Melting. The method of vacuum extraction described by Sloman was examined. Some disadvantages of this method were successfully eliminated by replacing the steel bath with a Cu bath at a working temperature of 1550 C. (*In Czech.*) Stanovení kysliku v hliníku tavením ve vakuu. ***Luboš Kopa.*** *Hutnické Listy,* v. 14, no. 4, Apr. 1959, p. 322-324.

8794* Influence of Surface Active Agents on Spectrophotometric Determination of pH. Effect of wetting agents on thymol blue itself in acid solutions. ***Indra Sanghi and N. V. Parthasarathy.*** *Indian Academy of Sciences, Proceedings,* v. 49, sec. A, no. 3, Mar. 1959, p. 144-150.

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8797 Colorimetric Determination of 2-Ethyl-1,3-hexanediol. 2-Ethyl-1,3-hexanediol gives a colored compound upon reaction with concentrated H_2SO_4 and *p*-dimethylaminobenzaldehyde which can be estimated colorimetrically. Method used for determination of the polyalcohol on glass, cloth, and human skin. ***Malcolm C. Bowman, Morton Beroza, and Fred Acree, Jr.*** *Journal of Agricultural and Food Chemistry,* v. 7, Apr. 1959, p. 259-261.

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8799* Polarographic Determination of Titanium in the Presence of Foreign Ions in Orthophosphoric Acid Fundamental Electrolyte. (*In Hungarian.*) A Ti(IV) polarográfiás meghatározása idegen ionok mellett ortofoszforsav vezető elektrolitban. ***Pál Szarvas, Lajos Máczay, and Arthur Gergely.*** *Magyar Kémiai Folyóirat,* v. 65, no. 2, Feb. 1959, p. 69-72.

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8801 A Composite Procedure for the Colorimetric Determination of Eleven Elements in Aluminium. A composite procedure is described, based on a 1 g. sample, for the colorimetric determination of small quantities of elements which might be found in aluminum. The eleven elements concerned are Fe, Cu, Si, Cr, Ni, Zn, Mn, Ti, V, Mg, and Pb. ***M. C. Steele and L. J. England.*** *Metallurgia,* v. 59, Mar. 1959, p. 153-156.

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8806* Nuclear Magnetic Resonance in Petroleum Analytical Research. Discussions are presented of the analytical process using high resolution nuclear magnetic resonance spectrometry, and of the use of spectra to elucidate molecular structure. Examples are given of the application of the nuclear magnetic resonance technique to simple multicomponent determinations, complex hydrocarbon type characterizations, and total hydrogen determinations. ***Rollie B. Williams.*** *Spectrochimica Acta,* v. 14, Jan. 1959, p. 24-44.

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sufficient decontamination to permit Np-237 estimation by alpha energy analysis and Np-239 estimation by gamma spectrometry. ***F. P. Roberts.*** *U. S. Atomic Energy Commission, HW*-59032, Jan. 28, 1959, 15 pp. (UF767 Un3.1hw Contin.)

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8812* Phthalocyanines as Oxidation-Reduction Indicators. V. Titration of Iron(II), Uranium(IV) and Molybdenum(V) With Sodium Vanadate. ***G. Gopala Rao and T. P. Sastri.*** *Zeitschrift für Analytische Chemie,* v. 167, no. 1, 1959, p. 1-7.

8813* Eriochrome Black A as Reagent for Spectrophotometric Microdetermination of Cobalt in Presence of Nickel. Suitable reagent for the spectrophotometric determination of microgram quantities of Co in pure Co solutions and in the presence of Ni and some other cations by measuring the decrease in the absorbance of Eriochrome black A at pH 10, caused by the presence of Co. ***Abdel-Aziz M. Amin, A. A. Abd El Raheem, and Farouk A. Osman.*** *Zeitschrift für Analytische Chemie,* v. 167, no. 1, 1959, p. 8-16.

See also: **9223** (X-ray spectrography); **9229** (infra-red instrumentation); **9230** (spectrochemical analysis); **9231** (spectroscopic source); **9707** (rubber analysis).

CHEMISTRY—INORGANIC AND GENERAL

8814 Advances in Inorganic Chemistry and Radiochemistry. Mechanisms of redox reactions of simple chemistry. Compounds of aromatic ring systems and metals. Recent studies of the boron hydrides. Lattice energies and their significance in inorganic chemistry. Graphite intercalation compounds. The Szilard-Chalmers reaction in solids. Activation analysis. Phosphonitrilic halides and their derivatives. Sulfuric acid solvent system. ***H. J. Emeléus and A. G. Sharpe, editors.*** v. I. 449 pp. 1959. Academic Press, New York. (QD1 Ad95 Vis.)

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8817 Reactions of Boron Carbide and Other Boron Compounds With Carbon Dioxide. The major part of the work concerns boron carbide, and the effects of temperature, pressure, and additions of water vapor and carbon monoxide are considered. Other materials investigated are ZrB_2, TiB_2, CrB_2, BN, BSi_6 and elemental boron. ***M. W. Davies and P. J. Phennah.*** *Journal of Applied Chemistry,* v. 9, pt. 4, Apr. 1959, p. 213-218.

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CHEMISTRY—ORGANIC

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8824* The Addition of Dimethylamine to Propylene Sulphide. The product of the reaction between dimethylamine and propylene sulfide in ether was studied in several ways and found to be 2-dimethylamino-propanethiol. ***Bertil Hansen.*** *Acta Chemica Scandinavica,* v. 13, no. 1, 1959, p. 151-158.

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8828 Sulfonation of Olefins. VIII. Formation of Unsaturated Sulfonic Acids. IX. Sulfonation of 1,1-Diphenylethene. X. The Preparation of Tertiary 5- and 6-Membered Ring Sultones. VIII. ***F. G. Bordwell and C. Edward Osborne.*** IX. ***F. G. Bordwell and M. L. Peterson.*** X. ***F. G. Bordwell, Richard D. Champman, and Edward Osborne.*** *American Chemical Society, Journal,* v. 81, Apr. 20, 1959, p. 1995-2007.

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8830 Guanylurea Salts. Physical and chemical properties, reaction rates, potential applications, and toxicity. *American Cyanamid Company, New Product Bulletin No.* 35, 26 pp. (S651 Am35n Vis.)

8831 Succinonitrile. Physical and chemical properties of succinonitrile as presented suggest its potential value in the fields of resins, pharmaceuticals, surface-active agents, and dyestuffs and in the preparation of important organic intermediates. *American Cyanamid Company, New Product Bulletin No.* 36, 26 pp. (S651 Am35n Vis.)

8832* Chelating Properties of N,N,N',N'-Tetrakis-(phosphonomethyl)-1,2-cyclohexanediamine. Preparation of a phosphonic acid chelating agent, and some of its properties. ***Charles V. Banks and Roger E. Yerick.*** *Analytica Chimica Acta*, v. 20, no. 4, Apr. 1959, p. 301-314.

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8837 The Chemistry of Adrenochrome and Related Compounds. Oxidation of catechol amines in dilute aqueous solution; preparative methods; mechanism of aminochrome formation; physical and chemical properties; preparation and properties of functional derivatives of the 5-carbonyl group. ***R. A. Heacock.*** *Chemical Reviews*, v. 59, no. 2, Apr. 1959, p. 181-237.

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8840 Chlorination of 2:3-Ethylenedioxy-1:4-dioxane. A summary of work on the chlorination of acetals in general and of 2:3-ethylenedioxy-1:4-dioxane in particular. ***L. A. Cort and R. G. Pearson.*** *Chemistry & Industry*, 1959, no. 16, Apr. 18, p. 515.

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8845 The Solubility of Organic Substances in Aqueous Soap Solutions. VIII. The Sodium Dodecyl Sulphate+Water+Caproic Acid and the Cetyl Trimethylammonium Bromide+Water+Caproic Acid Systems. IX. The Sodium Dodecyl Sulphate+Water+*n*-Octylamine System. VIII. ***B. J. Boffey, R. Collison, and A. S. C. Lawrence.*** IX. ***R. Collison and A. S. C. Lawrence.*** *Faraday Society, Transactions*, v. 55, Apr. 1959, p. 662-666.

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8847* Synthesis of Some Disubstituted 3,4,5,6,—Tetrafluorobenzenes. Synthesis from 2-chloroheptafluorotoluene. A new method for the hydrolysis of the trifluoromethyl group was developed using alumina and steam at high temperatures. ***Walter J. Pummer, Roland E. Florin, and Leo A. Wall.*** *Journal of Research, National Bureau of Standards*, v. 62, no. 3, Mar. 1959, p. 113-117.

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8850* The Ozonolysis of Phenanthrene. ***J. P. Wibaut and Th. J. De Boer.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, Mar. 1959, p. 183-189.

8851* Chemical Studies on Insecticides. IX. Infra-Red Absorption Spectra of Phosphorus Acid Esters. ***J. A. A. Ketelaar and H. R. Gersmann.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, Mar. 1959, p. 190-198.

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solid-gas molecule potentials. ***Terrell L. Hill.*** *Journal of Physical Chemistry*, v. 63, Apr. 1959, p. 456-460.

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8895* Adsorption of Helium, Neon and Hydrogen on Silica Gel and Alumina at the Temperature of Liquefied Nitrogen and High Pressure. (*In Polish.*) Adsorpcja helu, neonu i wodoru na żelu krzemionkowym i tlenku glinu w temperaturze ciekłego azotu pod wyższymi ciśnieniami. ***Andrzej Czapliński and Emil Zieliński.*** *Przemysł Chemiczny*, v. 38, no. 2, Feb. 1959, p. 87-88.

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8897* The Thermal Hydrolysis of Metal Chlorides. I. Cupric Chloride and Nickel Chloride. Hydrolysis was proved to occur at the interface with an adsorbed water layer. Heat of the reaction by which copper oxychloride is formed, and the activation energy of the hydrolytic reaction of nickel chloride were obtained. ***A. Glasner and I. Mayer.*** *Research Council of Israel, Bulletin*, v. A8, no. 1, Jan. 1959, p. 27-40.

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8899* Infrared Absorption Spectra of Inorganic Coordination Complexes. XIX. N-Methylacetamide Cadmium-II Chloride. ***Mary Martinette, S. Mizushima, and J. V. Quagliano.*** *Spectrochimica Acta*, 1959, no. 2, Apr., p. 77-81.

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8902* Mechanism of Reaction of Methylene With the Carbon-Hydrogen Bond. Evidence for Direct Insertion. ***W. von E. Doering and H. Prinzbach.*** *Tetrahedron*, v. 6, no. 1, Mar. 1959, p. 24-30.

8903* Bond Lengths and Bond Energies in Conjugation and Hyperconjugation. Shows that C—C bond-length shortenings predicted by up-to-date π-electron theory are not as great as usually supposed, and that the corresponding predicted lengthenings of C=C and C $\equiv$ bonds are almost *nil*. ***R. S. Mulliken.*** *Tetrahedron*, v. 6, no. 1, Mar. 1959, p. 68-87.

8904 The Strengths of Chemical Bonds. Experimental methods for determining bond dissociation energies in diatomic and polyatomic molecules. Methods of determining the heats of formation of molecules. Attention is given to the reliability and accuracy of the various methods and results. Numerical values of heats of atomization are listed and critically examined, and a table of internuclear distances and force constants is included for those bonds for which energtic information is available. ***T. L. Cottrell.*** 2nd Ed. 317 pp. 1958. Butterworths Scientific Publications, London. (QD501 C82s2)

8905 The Vapor Pressure of Nitrobenzene at Low Temperatures. Vapor pressures measured over a range of temperatures from 6 C to 23 C and at atmospheric pressure using a packed bed technique. ***Edward J. Lynch and Charles R. Wilke.*** *U. S. Atomic Energy Commission, UCRL-8601,* Jan. 14, 1959, 9 pp. (UF767 U3u Contin.)

8906* Stability of Metal Complexes in Solution. III. Ion Association in Ferric Sulphate and Nitrate Solutions at Low *Fe III* Concentration. A Potentiometric Study. ***B. N. Mattoo.*** *Zeitschrift für Physikalische Chemie,* v. 19, nos. 3/4, Feb. 1959, p. 156-167.

8907* The Optical Properties of Hydrochloric-Boric Acid Mixtures. The dissociation constant of thymol blue was determined spectrophotometrically. The optical density of HCl solutions containing various amounts of boric acid, and tinted with thymol blue, decreases linearly at low concentrations of boric acid. ***Hussein Sadek and Th. F. Tadros.*** *Zeitschrift für Physikalische Chemie,* v. 19, nos. 3/4, Feb. 1959, p. 193-201.

8908* Hydrogen Bonding and Protonation Effects on the Electronic Spectra of Nitrogen Heterocycles: Pyridine. ***Shizuyo Mataga and Noboru Mataga.*** *Zeitschrift für Physikalische Chemie,* v. 19, nos. 3/4, Feb. 1959, p. 231-245.

8909* The Effect of Isoamyl Alcohol on Critical Phenomena in the System Triethylamine—Water. Viscosity of mixtures of triethylamine and water in the presence of small isoamyl alcohol additions, determined by a capillary method. (*In Russian.*) Vliianie izoamilovogo spirta na kriticheskie iavleniia v sisteme trietilamin–voda. ***E. L. Zorina and V. K. Semenchenko.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 3, Mar. 1959, p. 523-533.

8910* The Action of Cobalt Stearate and Ozone in the Liquid Phase and Emulsion Oxidation of Cumene. Oxidation velocity of isopropylbenzene in the presence of bi- and trivalent cobalt stearates at 90 C. (*In Russian.*) Deĭstvie stearata kobal'ta i ozona pri zhidkofaznom i emul'sionnom okislenii kumola. ***R. V. Kucher.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 3, Mar. 1959, p. 617-626.

8911* The Physical Chemistry of Concentrated Ozone. IV. The Explosibility of Concentrated Ozone Under the Influence of Heat. Initiation of concentrated liquid and gaseous ozone by electrically heated tungsten filaments has been investigated using a procedure allowing the desired temperature of the filament to be accurately established. (*In Russian.*) Fiziko-khimiia kontsentrirovannogo ozona. IV. Vzryvnaia chuvstvitel'nost' kontsentrirovannogo ozona po otnosheniiu k teplovym bozdeĭstviiam. ***V. V. Iastrebov and N. I. Kobozev.*** *Zhurnal Fizicheskoĭ Khimii,* v. 33, no. 3, Mar. 1959, p. 649-655.

See also: **8805** (precipitation); **8913** (ionizing radiation on semiconductor coated metals); **9471** (dendritic crystallization).

COATINGS

8912 High Precision Nondestructive Thickness Measurements of Organic Coatings. Rapid, nondestructive method can be carried out with any infrared spectrometer equipped for reflectance measurements. ***E. P. Brightwell.*** *ASTM Bulletin,* no. 237, Apr. 1959, p. 67-69.

8913* Effect of Ionizing Radiation on the Electrochemical Activity of Metals Coated With Semiconducting Oxide Films. A study of the effect of electron radiation (E = 0.8 Mev, I = 10 $\mu a/cm^2$) on the electrochemical behavior of a series of metals in a wide interval of density of the polarizing current. Electron bombardment showed the electrochemical activity of metals with surface films with a different conductivity mechanism in relation to the cathodic and anodic reaction. (*In Russian.*) Vliianie ioniziruiushchego izlucheniia na elektrokhimicheskuiu aktivnost' metallov, pokrytykh okisnymi plenkami poluprovodnikovogo kharaktera. ***I. L. Rozenfel'd and E. K. Oshe.*** *Akademiia Nauk SSSR, Doklady,* v. 125, no. 1, Mar. 1, 1959, p. 139-142.

8914* Advances in Heat-Set Ink Varnishes. ***Daniel O'Conner.*** *American Ink Maker,* v. 37, Apr. 1959, p. 40 + 3 pages.

8915 Aluminum Tallate Polymers. Description of a series of Al derivatives of the purified tall oils and their application possibilities. ***J. Rinse.*** *American Paint Journal,* v. 43, May 4, 1959, p. 68 + 2 pages.

8916* The How and Why of Carton Lithography. VIII. Ink Pigments and Vehicles. What the carton manufacturer should know about the pigments and vehicles used in offset inks. *Boxboard Containers,* v. 77, May 1959, p. 105-107.

8917 Electrical Insulating Properties of Porcelain Enamels at Elevated Temperatures. ***C. G. Bergeron.*** *Ceramic Age,* v. 73, no. 4, Apr. 1959, p. 59-60.

8918* Esso's C-Oil Now Being Market Developed in U. K. Description and applications of C-Oil. C-Oil type MDE-1 is a viscous liquid suitable for casting or impregnating; while C-Oil type MDE-2 is designed primarily for baked surface coatings. *Chemical Age,* v. 81, Apr. 11, 1959, p. 614.

8919 The Evaluation of Enamel Magnet Wire. This paper is a discussion of the need to broaden the base of test procedures relating to enameled magnet wires. Of importance, in this respect, are: (1) compatibility of the wire enamels with other substances, both of insulating function and environmental in nature, which are present in a complete electrical system; (2) thermoplastic flow properties; (3) heat shock characteristics; (4) change of reaction rate of aging properties with increase in temperature; (5) heat softening after extended aging; (6) retention of flexibility after aging; and (7) winding problems reflected in abrasion resistance; flexibility, reaction to rapid elongation, etc. ***H. L. Saums and W. W. Pendleton.*** *Communication and Electronics,* 1959, no. 41, Mar., p. 1-4.

8920* How to Specify Insulating Varnishes for Equipment Reliability. Review of insulating varnishes as key components in a given electrical insulation system. Selection of an optimum varnish requires appraisal of many types of varnishes and of many factors including inherent physical, thermal, and dielectric characteristics, compatibility with other system elements, and application techniques. ***D. L. McClenahan.*** *Electrical Manufacturing,* v. 63, May 1959, p. 100-105.

8921* Tropical Proof Coatings. Deals individually with protective coatings for iron and steel objects, light metal component parts, and wooden materials. The different protecting varnishes as the protecting measures against biological actions (termites, fungi) are dealt with and modern packing systems are described. (*In Hungarian.*) Trópusálló bevonatok. ***Joachim Morgner.*** *Elektrotechnika,* v. 51, nos. 7-9, 1958, p. 368-379.

8922 Brass-Surfacing of Ferrous Metals by the Flame-Fluxing Technique. A flame-fluxing technique now being used in Russia employs a special gas-forming flux to improve the quality of the deposited metal layers and to prevent boiling out of the Zn from the filler metal. ***G. A. Asinovskaya, E. V. Belova, and H. M. Zelikovskaya.*** *Engineers' Digest,* v. 20, Apr. 1959, p. 155-156. (From *Svarochnoye Proizvodstvo,* no. 2, Feb. 1959, p. 28-31.)

8923* Hot-Dip Tinning of Cast Iron. Oxidation methods—the "direct chloride" process—comparison of the different processes. (*In German.*) *Feuerverzinnung von Gusseisen.* ***Ernest S. Hedges.*** *Geisserei,* v. 46, no. 9, Apr. 23, 1959, p. 233-236.

8924 Observations on the Process of Nickel Deposition by Thermal Decomposition of Nickel Carbonyl at Low Pressures. Details are given of the variables controlling the process and the properties of the coatings obtained, such as appearance, micro-structure, micro-hardness, and ductility. The role of variables is discussed and an attempt is made to relate these factors with each other and the properties of the coating. ***L. W. Owen.*** *Metallurgia,* v. 59, Apr. 1959, p. 165-173.

8925 Transfer Labeling in the Round. New machine applies intricately designed wrap-around labels to round squeeze bottles for Union Carbide insecticide and decorates oval containers 35% faster than original equipment. *Modern Packaging,* v. 32, no. 9, May 1959, p. 108-109.

8926* Techniques of Printing on Foil. Aluminum foil jobs gain in popularity. Here's how they are done. *National Lithographer*, v. 66, May 1959, p. 12 + 1 page.

8927* Labeling Bottles Almost Too Small to Hold. Requires machine spotting of pressure-sensitive labels plus manual technique to secure them in place. ***Herbert J. Oglesby.*** *Package Engineering*, v. 4, Apr. 1959, p. 44-46.

8928* Review and Buyers' Guide. World wide review of synthetic resins, emulsions, drying oils, solvents, pigments, driers, additives, and coatings. *Paint and Varnish Production*, v. 49, no. 4, Mar. 1959, 218 pp.

8929* The Alkyd Composition Graph and Its Applications. ***William M. Kraft.*** *Paint and Varnish Production*, v. 49, no. 5, Apr. 1959, p. 33 + 4 pages.

8930* Can the Paint Industry Profit by Market Research? Discusses the problem and concludes that chemical market research is necessary both within a company and by outside firms. ***Jay R. Willner.*** *Paint and Varnish Production*, v. 49, no. 5, Apr. 1959, p. 41-42.

8931* Cyclized Rubber in Protective Coatings. IV. Concludes a discussion of the film properties of cyclized rubber coatings. Also featured are binder compositions of cyclized rubber coatings for various end use products. *Paint and Varnish Production*, v. 49, no. 5, Apr. 1959, p. 45 + 3 pages.

8932* Anti-Corrosive Paint System for Maintenance Applications. New anti-corrosive paints produced by AB Wilh. Becker in Stockholm, reduce the number of coats necessary. *Paint and Varnish Production*, v. 49, no. 5, Apr. 1959, p. 89-90.

8933* Recent Developments in Soviet Paint Technology. Formulation of coating resins free of vegetable oils, glycerine and phthalic anhydride, has spurred interest in the development of phenolic, vinyl and latex emulsion coatings. Ship coatings with a phosphatized vinyl-acrylic type primer, vinyl coatings containing a high content of cuprous oxide, zinc rich paints, and rubber coatings. Development of bactericidal paints by the Soviets, the activity of which is said to last as long as 400-500 days. *Paint and Varnish Production*, v. 49, no. 5, Apr. 1959, p. 91-92.

8934 Silicone Resins in Surface Coatings. The resistance to heat, chemicals, and weathering exhibited by silicone resins can be acquired by paints in which they are incorporated. Selection of suitable resins, pigments and driers is essential to obtain the best results. ***D. R. Goddard and E. A. Mason.*** *Paint Manufacture*, v. 29, May 1959, p. 155 + 4 pages.

8935 Importance of Solvents in Nitrocellulose Lacquers. Blends of solvents must be used to overcome the faults of individual solvents. Rate of evaporation, compatibility, toxicity and cost, are among the aspects requiring consideration. ***W. F. Daggett.*** *Paint Manufacture*, v. 29, May 1959, p. 159 + 4 pages.

8936 New Raw Materials for Paints and Inks. Variations in the architecture of synthetic resins become possible when trimethylol ethane and trimethylol propane are introduced into polymer molecules. Acceptance will depend on their usefulness. ***P. W. Sherwood.*** *Paint Manufacture*, v. 29, May 1959, p. 163 + 2 pages.

8937* Fire Retardant Coatings. Formulating With Isano Oil. Unusual ingredient provides powerful intumescent action and a flexible film, also offers weather resistance for outside use. *Paint, Oil & Chemical Review*, v. 122, Apr. 30, 1959, p. 8-11.

8938 The Beta-Hydroxyl of Glycerol. Natural oil fatty acid distribution is probably not random. ***M. R. Mills.*** *Paint Technology*, v. 23, Apr. 1959, p. 129-132.

8939* Tall Oil Rosin Contains Palustric Acid. A short review of the structure and properties of palustric acid. The isolation of this acid from tall oil rosin is described. (*In Swedish.*) Talloljeharts innehåller palustrissyra. ***Henrik H. Bruun.*** *Paperi ja Puu*, v. 41, no. 3, 1959, p. 73-75.

8940* Single Coat Multi-Coloured Finishes. Multi-colored finishes consisting of pigmented particles of paint or lacquer suspended in an aqueous phase cut finishing costs. ***W. H. Morris.*** *Product Finishing*, v. 12, Apr. 1959, p. 105-107.

8941 Seal Coats and Surface Treatments. Construction of roadways consisting of an application of bituminous material to a prepared surface followed by an application of aggregate. ***Fred J. Benson.*** *Purdue University, Road School, Proceedings, 44th Annual Road School*, 1958, p. 73-80. (TE1 P97.6p Vis.)

8942 Use of Fe^{55} for Measuring Titanium Coating Thickness. A simple method of measuring coating thickness based on secondary X-ray emission is described. Fe^{55} emits negligible amounts of radiation other than the manganese *K* lines, and these can only excite the *K* spectra of elements lighter than Mn in the periodic table, and *L* spectra of elements lighter than Pr^{61}. ***P. D. Zemany.*** *Review of Scientific Instruments*, v. 30, Apr. 1959, p. 292-293.

8943* A Paint Applicator for Coloring Wire Jackets. An apparatus which eliminates material and time-consuming operations in color coding extruded wires. ***S. Vicino, Jr.*** *Rubber Age*, v. 84, no. 5, Feb. 1959, p. 795-797.

8944* PVC Surface Coatings for Steel. *Rubber and Plastics Age*, v. 40, Apr. 1959, p. 351.

8945* Effect of the Preparation of Bonding Surface for Metal Spraying on the Fatigue Strength of Machine Components. (*In German.*) Der Einfluss der Haftgrundvorbereitungsmethoden für das Metallspritzverfahren auf die Dauerfestigkeit von Maschinenteilen. ***V. Linhart and E. Kretzschmar.*** *Schweisstechnik* (Berlin), v. 9, Mar. 1959, p. 83-89.

8946* The Chemical Surface Treatment of Steel Strip as a Protection Against Corrosion, to Improve the Adhesive Strength of Coatings and to Form Insulating Layers. Surface treatment of steel strip to improve the storekeeping ability and the adhesion of varnish and plastic coatings. The application of insulating layers to electric sheets. Phosphate coatings to facilitate the workability of deep drawing steel sheets. Increasing the resistance to corrosion and the adhesion of varnish of galvanized sheets. (*In German.*) Die chemische Oberflächenbehandlung von Stahlband zum Schutz gegen Korrosion, zur Verbesserung der Haftfestigkeit von Überzügen und zur Bildung von Isolierschichten. ***Werner Rausch.*** *Stahl und Eisen*, v. 79, no. 6, Mar. 19, 1959, p. 349-356.

8947* Recent Experiences Made in Single-Coat White Enameling. Investigations were carried out on cold-rolled sheets, 1 mm. thick, made of soft plain carbon steels in the as-delivered condition and after annealing in vacuum as well as on 2.3 mm. sheets of a steel containing 0.33% Ti. Effect of Ti content of the steel, preparatory treatment of the sheets, and chemical composition and physical properties of the enamel on surface condition and adhesion. (*In German.*) Neue Erfahrungen beim Einschicht-Weissemaillieren. ***Walter Tepohl.*** *Stahl und Eisen*, v. 79, no. 6, Mar. 19, 1959, p. 356-361.

8948 Flexible Line Automates Hot Dip Galvanizing. Machinery uses electrical controls and program timers to process small or large parts. All items pass through the same pickling line and galvanizing kettle. Small parts, in baskets, are spun in a centrifuge; larger ones, mounted on racks, pass through a quench tank. *Steel*, v. 144, Apr. 27, 1959, p. 104-105.

8949 Spectral Emittance of Uncoated and Ceramic-Coated Inconel and Type 321 Stainless Steel. The normal spectral emittance of Inconel and type 321 steel with different surface treatments was measured at temperatuers of 900, 1200, 1500, and 1800 F over a wavelength range of 1.5 to 15μ. The measurements involved comparison of the radiant energy emitted by the heated specimen with that emitted by a standard at the same temperature. Surface treatments included electropolishing, sandblasting, electropolishing or sandblasting followed by oxidation, and application of NBS coating A-418 and ceramic coating N-143. ***James E. Stewart.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 4-9-59W, Apr. 1959, 30 pp. (TL782 Un3rm Vis.)

8950* Silicone Resins and Their Application as Heat Resisting Lacquer Binders. Characteristics lie between the organic high polymers and the inorganic silicates; they combine good flexibility and high thermal resistance. As a binder for

lacquers and enamels they provide both surface protection and insulation. (*In German.*) Siliconharze und ihre Verwendung als hitzebeständige Lack-Bindemittel. ***Walter Krauss.*** *VDI Zeitschrift*, v. 101, no. 10, Apr. 1, 1959, p. 377-382.

8951 Hardfacing Drill Bits—Another Contribution to the Oil Industry. Deposition of WC by automatic gas-shielded arc process. *Welding Engineer*, v. 44, May 1959, p. 35-36.

8952* New Cellulosic Plastic Finish Improves Life and Finish of Fabricated Wire Products. Description of a new plastic material for products and its method of application. ***Walter R. Pascoe.*** *Wire and Wire Products*, v. 34, Apr. 1959, p. 461 + 1 page.

8953* Electrical Resistance Characteristics of Polyvinyl Chloride Formulations. ***Mansfield Williams and J. R. Taylor.*** *Wire and Wire Products*, v. 34, May 1959, p. 577 + 5 pages.

See also: **9326** (adherence of sprayed metal coatings); **9522** (inspection of clad metals); **9694** (silicone properties and applications); **9722** (finishing industry dust problems).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

8954* Designing a Safe Servo. Describes magnetically positioned electro-hydraulic servo with failsafe feedback-loop. ***Robert Hayos.*** *Aircraft and Missiles Manufacturing*, v. 2, May 1959, p. 22-25.

8955* Radix Exchange—An Internal Sorting Method for Digital Computers. Describes a new technique—Radix Exchange—for sorting data internal to the high speed memory of an electronic binary digital computer. Its speed compares favorably with internal merging and it requires essentially no working area in addition to that storage for the data being sorted and the instructions comprising the Radix Exchange routine itself. ***Paul Hildebrandt and Harold Isbitz.*** *Association for Computing Machinery, Journal*, v. 6, no. 2, Apr. 1959, p. 156-163.

8956* Memory Efficiency. Memory-active time and total computer running time—determined from analyzed computer programs—are reported. The 1103 Univac Scientific computer was used for the study. ***Gertrud S. Joachim.*** *Association for Computing Machinery, Journal*, v. 6, no. 2, Apr. 1959, p. 172-175.

8957* On Exponential Digital Filters. Derives the weighting sequence of a linear digital filter whose output is an estimate of the predicted values of the derivatives of the input. The input functions considered are arbitrary linear combinations of $n + 1$ known functions, plus a random stationary signal and a random stationary noise component. A modification of the exponential filter is considered such that the bias error is zero. The solution then involves a recursion formula with time varying coefficients. ***Marvin Blum.*** *Association for Computing Machinery, Journal*, v. 6, no. 2, Apr. 1959, p. 283-304.

8958 Miniaturized Digital Computing Systems. The authors discuss a recent development, the miniaturized large capacity high speed digital computer which will allow precise control of advanced aircraft and space vehicles. ***Frederic A. Foss and Robert E. Lyons.*** *Astronautics*, v. 4, May 1959, p. 42 + 5 pages.

8959 Use of An Electronic Analogue Computer With Resistance Network Analogues. Describes a method of solving partial differential equations of the elliptical type, with the aid of an electronic analogue computer in conjunction with a resistance network. In case the iteration process proves to be divergent, an additional voltage source connected with a well-chosen node may offer a solution. ***J. Ph. Korthals Altes.*** *British Journal of Applied Physics*, v. 10, Apr. 1959, p. 176-180.

8960* Techniques for the Recording of, and Reference to Data in a Computer. Some useful techniques for storing labelled data in an electronic digital computer are summarized, and various methods for rearrangement of, and reference to, the data are discussed in more detail than has hitherto been attempted. ***A. S. Douglas.*** *Computer Journal*, v. 2, no. 1, Apr. 1959, p. 1-9.

8961* The X-1 Computer. Description of a small, fast, transistorized computer, designed basically for commercial data-processing, developed by the staff of the Mathematical Centre, Amsterdam. ***B. J. Loopstra.*** *Computer Journal*, v. 2, no. 1, Apr. 1959, p. 39-43.

8962 Conference Papers. Conference on Electronic Computation. This book is a collection of papers on the capabilities of digital computers and the implication of their use on the activities of the structural engineer. Significant contributions in the use of digital computers in design analysis and in research are described. Mathematical techniques are described and methods of programming are discussed. American Society of Civil Engineers, Kansas City, Missouri. 1958, 436 pp. (QA76 C76c)

8963 Feed Forward Can Improve Feedback Controls. Describes a "feed-forward" unit and techniques applicable wherever system error is a function of the input signal. ***R. L. Duthie.*** *Control Engineering*, v. 6, May 1959, p. 136-140.

8964 Data Collection Problems in Second Generation Ballistic Missiles. This paper deals with the problem of airborne data collection from advanced ballistic missiles. A summary is presented of the advantages and problems of recording high speed pulse or digital data on the ground with wideband video tape recorders. ***Loren Clifford Sackett.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 1, Mar. 1959, p. 1-7. (TK1 In6.6r Vis.)

8965 An Automatic Data Handling System of High Speed and High Capacity. Describes salient characteristics which now exist in the final design of high-speed, high-capacity automatic data handling systems. Design features intended to make the over-all system appropriate for a high order of automatic operation are emphasized. ***R. L. Sink, C. E. Pettingall, and B. N. Posthill.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 1, Mar. 1959, p. 8-13. (TK1 In6.6r Vis.)

8966 Frequency Domain Applications to Data Processing. Filtering a set of $(2N + 1)$ sampled data consists in taking a weighted average of these data. The only filters discussed in this paper are those for which the weights are either symmetric or skew symmetric about the center weight. Power of filtering techniques and precautions to take in their use for data processing are discussed. ***Marcel A. Martin.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 1, Mar. 1959, p. 33-41. (TK1 In6.6r Vis.)

8967* The Design of Conditional Probability Computers. A special purpose computer is described which calculates conditional probabilities. The computer can be extended to forecast the probability of future signals and the past can be weighed in any desired manner. Full details are given for the construction of such machines. ***A. M. Uttley.*** *Information and Control*, v. 2, no. 1, Apr. 1959, p. 1-24.

8968* Inevitable Experimental Errors, Determinism, and Information Theory. It is shown that experimental errors are inevitable, and it is unscientific to think of infinite accuracy in any measurement. Some simple examples are discussed which show the type of uncertainties encountered even in classical models. The inevitable errors must be included in the theory, since they are an essential part of our knowledge of the world around us. This makes strict determinism impossible in scientific prediction. ***L. Brillouin.*** *Information and Control*, v. 2, no. 1, Apr. 1959, p. 45-63.

8969* Logging and Monitoring Equipment for Chemical Plant. Description of the equipment which provides temperature monitoring and data logging of a continuous chemical process at an Imperial Chemical Industries plant. *Instrument Practice*, v. 13, Apr. 1959, p. 413-415.

8970* Magnetization Reversal by Rotation and Wall Motion in Thin Films of Nickel-Iron Alloys. The magnetization reversal process in specially prepared uniaxial thin films of Ni-Fe alloy is studied by measurements of the 400 c.p.s. hysteresis loops. Special properties of these films are discussed for fields applied normal to the anisotropy axis. ***E. M. Bradley and M. Prutton.*** *Journal of Electronics and Control*, v. 6, no. 1, Jan. 1959, p. 81-96.

8971 Proceedings of the EIA Symposium on Numerical Control Systems for Machine Tools. Sixteen papers representing the technical transactions. 106 pp. 1957. Engineering Publishers, Division of the AC Book Co., Inc., New York. (TJ1189 EL25.2p)

8972* A Simplified Theory of Feedback Control Systems. X. Describes the synthesis of a feedback compensating device, in the light of an example taken from the position-control field. ***P. Naslin.*** *Process Control and Automation*, v. 6, Apr. 1959, p. 165-168.

8973 Space Age Computing. This is an account of the role that computing and data processing played in Project Able-1 (Pioneer). It may indicate the demands that unnamed missions of the future will place on tomorrow's computers. ***Robert W. Rector.*** *Research & Engineering*, v. 5, Mar.-Apr. 1959, p. 8-14.

8974 The Punched Card Machine Accounting and Data Processing Semi-Annual. A business publication dedicated to advancement and enlightenment of the science of punched card accounting, and electronic and integrated data processing. ***D. A. Talucci, editor.*** v. VII. 171 pp. 1958. Gille Associates, Inc., Detroit. (HF5371 P96 Over.)

See also: **8741** (digital computers on stripper-stabilizer probblems); **8742** (plate-to-plate computer program); **8982** (F-M motor); **9014** (automatic transister assembly); **9221** (product-integral computor); **9225** (random number generator); **9425** (speed control system).

ELECTRICAL ENGINEERING

8975* Electrical Propulsion Systems in Space Fight. It is suggested that one possibility for electrical propulsion systems in space flight lies in the development of a plasma generator in which nuclear energy is used to heat up a plasma which expands through a magnetic field. The work done by the plasma would appear directly as electrical energy. ***L. R. Shepherd.*** *Astronautica Acta*, v. 5, no. 2, 1959, p. 144-157.

8976* Direct Transformation of Heat Into Electric Power. The Thermoelectric Phenomenon. Historical background of thermoelectricity; results obtained in Russia with the Peltier effect; research of the Westinghouse Electric Co.; characterization of the thermoelectrical materials according to their parameters; physical interpretation of thermoelectricity, selection of wide and of narrow band materials; future prospects. (*In French.*) La transformation directe de la chaleur en énergie électrique. Le phénomène thermoélectrique. ***G. Genin.*** *Chaleur & Industrie*, 1959, no. 404, Mar., p. 59-71.

8977 A Review of Telephone Development in Western Europe and in Underdeveloped Areas. A look at telephone development around the world. An appraisal of telephone growth potential in the lesser developed countries is also included. ***G. D. Wallenstein.*** *Communication and Electronics*, 1959, no. 41, Mar., p. 15-22.

8978 The Present Status and Anticipated Progress in the Field of Insulating Materials. A critical evaluation of the present state of dielectrics and anticipated progress in the field of insulating materials. ***Thomas D. Callinan.*** *Communication and Electronics*, 1959, no. 41, Mar., p. 22-27.

8979 Design of Random-Noise Transformers. A method of choosing the core required for transformers which must handle random-noise voltages and experimental verification of this method are described. ***M. P. Vore.*** *Communication and Electronics*, 1959, no. 41, Mar., p. 59-63.

8980 Magnet Wire for 600 C Temperature Transformers. A summary of the planning and results of an ultrahigh-temperature heat-aging program designed to screen selectively the most promising magnet wires to operate 1000 hrs in the ambient temperature range −65 C to 500 C. ***W. W. Wareham.*** *Communication and Electronics*, 1959, no. 41, Mar., p. 66-70.

8981 Factors Leading to the Development of Ceramic Hydrogen Thyratrons. Describes general design considerations, performance test results, and problems in further extension of hydrogen thyratron ratings. ***H. N. Price and A. W. Coolidge.*** *Communication and Electronics*, 1959, no. 41, Mar., p. 76-80.

8982 The F-M Motor. A New Actuator and Computing Element. Describes the frequency-modulated motor, which is responsive to changes in signal frequency rather than signal amplitude. Its performance characteristics are discussed and brief application notes are given. ***Kurt Burian and Robert S. Jamieson.*** *Control Engineering*, v. 6, May 1959, p. 106-109.

8983 Phase-Controlling Kilowatts With Silicon Semiconductors. Discusses the basic unijunction-transistor/controlled-rectifier circuitry, and introduces specific circuits for the armature control of dc motors, for the control of illumination intensity and heat, and for the control of bidirectional clutch systems or split-field generators. ***F. W. Gutzwiller.*** *Control Engineering*, v. 6, May 1959, p. 113-119.

8984* Can Russia Overpower U.S.? A report on electric power in the U.S.S.R. by U.S. power industry representatives who visited the U.S.S.R. last year. *Electric Light and Power*, v. 37, no. 9, May 1, 1959, p. 81-100.

8985 Basic and Applied Engineering Research. ***C. Guy Suits.*** *Electrical Engineering*, v. 78, May 1959, p. 415-422.

8986 The Evolving Technology of Communication. ***E. I. Green.*** *Electrical Engineering*, v. 78, May 1959, p. 470-480.

8987 Advances in Communications. ***H. I. Romnes.*** *Electrical Engineering*, v. 78, May 1959, p. 481-492.

8988 Telegraphy's Next 25 Years. ***I. S. Coggeshall.*** *Electrical Engineering*, v. 78, May 1959, p. 493-499.

8989 Twenty-Five Years of Progress in Aircraft Electrical Systems. ***Peter Duyan, Jr.*** *Electrical Engineering*, v. 78, May 1959, p. 527-533.

8990 Growth and Development in the Electric Power Industry. ***Philip Sporn.*** *Electrical Engineering*, v. 78, May 1959, p. 542-555.

8991* Key to Metals in Design Engineering. An interpretation of basic characteristics and behavior. Fundamental structures; nature and specifications of metals; physical and mechanical properties; environmental effects; iron and steel; aluminum and aluminum alloys; copper alloys; precious and rare metals; nickel alloys; magnesium and magnesium alloys. ***Sidney H. Avner and Harold E. Barkan.*** *Electrical Manufacturing*, v. 63, May 1959, p. 123-146.

8992 Electrical Safety. A technical outline of the many and diverse matters which go to make up the whole picture of electrical safety. The book is written in the main along factory electricity regulations. ***H. W. Swann.*** 292 pp. 1959. Philosophical Library, New York. (TK152 Sw24e)

8993 Development of Accelerated Life Test Procedures for Carbon Composition Resistors. Describes a 1000-hour exploratory experiment employed to find the optimum stress operating conditions for accelerated tests for ½-watt carbon composition resistors. A factorial design using ambient temperature and initial power dissipation as the axes of the factorial was used for the experiment. ***B. C. Spradlin and H. M. Braner.*** Paper from "Fifth National Symposium on Reliability and Quality Control in Electronics", Institute of Radio Engineers, New York, 1959, p. 307-318. (TK7801 N21p Over.)

8994* The Structure of Superconductors. Clarifying the relationships between microscopic structure and macroscopic behavior may add to the store of knowledge of the phenomena

of superconductivity and simultaneously answer a number of questions pertaining to the desired characteristics of materials. ***William B. Ittner, III.*** *New York Academy of Sciences, Transactions*, v. 21, no. 5, Mar. 1959, p. 406-413.

8995* Teflon 100X FEP Wire and Cable Insulation: Its Place in the Fluorocarbon Family. Study of the comparative electrical insulation performance of three fluorocarbons. ***William M. Land.*** *Wire and Wire Products*, v. 34, Apr. 1959, p. 444 + 11 pages.

See also: **8693** (selection of ceramic insulators); **8917** (insulating properties of porcelain enamels); **8919** (magnet wire); **8920** (insulating varnishes); **8953** (electrical resistance of P.V.C.); **9179** (generating plant for reserve capacity); **9540** (radiation effects on insulation).

ELECTROCHEMISTRY

8996 Electroplating on Thorium. A method was developed for treating thorium whereby adherent electroplates of most metals can be applied. The method involves anodic pickling in hydrochloric acid and chemical pickling in sulfuric acid prior to plating. Factors affecting the adherence and protective qualities of the coatings are discussed. ***John G. Beach and Glenn R. Schaer.*** *Electrochemical Society, Journal*, v. 106, May 1959, p. 392-393.

8997* Four Integrated Systems Handle Complex Missile Plant Plating Solutions. The major source of waste in the manufacturing process is from plating operations. Missile and rocket components are made of a variety of materials which require many different types of plating. Among the plating processes are the following: (1) HNO_3, HF, and H_2SO_4 pickling—producing acid wastes; (2) Cd, Ag, and Cu plating—producing cyanide wastes; and (3) anodizing, iriditing, chrome plating, and chrome sulfuric cleaning—producing chromate and alkali wastes. ***C. Sweglar.*** *Industrial Wastes*, v. 4, no. 3, May 1959, p. 40-42.

8998* Titanium Salt Electrolysis. The reason why the fused salt electrolysis should be adopted to the electrolytic production of metallic Ti is discussed together with the electrode process that may occur in the molten baths. A research program was initiated to determine the feasibility of an electrolytic method for the production. Not only did the electrolytic method produce highly pure metallic Ti, but the mechanism of the electrode reactions was disclosed through the research. ***Shiro Yoshizawa and Tomoyasu Hashino.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 55, Feb. 1959, 19 pp.

8999* New Battery for Aircraft. A new kind of battery is being used in some aircraft, partly because it gives unusually long life, partly because it works well at low temperatures and partly, where heavy currents are needed for engine starting, because it is smaller and lighter than the batteries formerly available. It is the Ni-Cd alkaline battery recently made suitable for heavy duty by introducing sintered plate construction. In the new battery the electrodes are made by sintering carbonyl-Ni powder on to a suporting framework of wire mesh or perforated strip. This forms a highly porous but rigid structure to support the active mass which, as in the conventional alkaline battery, consists of Ni and Cd hydrates as positive and negative plates. The electrolyte is a 30 per cent by weight solution of KOH. *New Scientist*, v. 5, Apr. 23, 1959, p. 905.

9000 Progress in the Development of a Nonembrittling Cadmium Electroplating Process. In the preliminary assessment of the embrittlement characteristics of these baths, the results indicate that the glycinate, methanol and triethanolamine solutions are far less embrittling than the cyanide bath and therefore warrant further investigation. ***P. N. Vlannes, S. W. Strauss, and B. F. Brown.*** *Plating*, v. 46, May 1959, p. 467-468.

See also: **9295** (corrosion resistance of electrodeposits on steel).

ELECTRONICS

9001* Action of a Progressive Perturbation on a Guided Electromagnetic Wave. Solutions to the equation of propagation in the perturbed medium are derived for an electromagnetic guide by using the so-called perturbation method. (*In French.*) Action d'une perturbation progressive sur une onde électromagnétique guidée. ***J. -C. Simon.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 3-16.

9002* New Applications of Ferrites at Hyper-High Frequencies. Two arrangements which extend the microwave application of ferrites are described: (1) coaxial waveguides partially filled with a dielectric that can be used for designing ferrite isolators and (2) the Faraday effect on a circular waveguide is utilized to produce rapid modulation in a waveguide. (*In French.*) Nouvelles applications des ferrites en hyperfréquences. ***F. Dachert, J. Robieux, and P. Trévoux.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 17-30.

9003* A Contribution to the Study of Small-Size Semiconductors at Low Temperatures. A study of the transistor under breakdown conditions for weak currents at various temperatures. The use of this transistor as a hyperfrequency mixer is described. The tests results are presented which exhibit the magnetron type cut-off in transistor type structures having a very small base thickness, of the order of 1μ. (*In French.*) Contribution a l'etude des structures semi-conductrices de faibles dimensions a basses températures. ***O. Garreta.*** *Annales de Radioélectricité*, v. 14, no. 55, Jan. 1959, p. 47-72.

9004* On the Frequency Modulation of Tuned Circuit- and Relaxation Oscillations. Distortion-free frequency modulation of oscillators for any desired modulation frequencies is considered. It is here found that every system of modulation that allows a tuned circuit to be modulated in its natural frequency without distortion and incidental amplitude modulation remains an ideal frequency modulator also for the nonlinear case of excited circuit. (*In German.*) Über die Frequenzmodulation von Schwingkreis- und Relaxationsoszillatoren. ***Ernst Kettel.*** *Archiv der Elektrischen Übertragung*, v. 13, Mar. 1959, p. 95-100.

9005* Contribution to the Transformation on Inhomogeneous Lines. A method is outlined with which the problem of impedance transformation on inhomogeneous lines can be treated to a good approximation. (*In German.*) Beitrag zur Transformation mit inhomogenen Leitungen. ***Erwin Baur.*** *Archiv der Elektrischen Übertragung*, v. 13, Mar. 1959, p. 114-120.

9006* Signal Transmission by Light Pulses. A theoretical investigation of the influences of luminous density, optical systems, visual range, and daylight illumination on pulse-optical transmission systems. Examples of the implementation of the system are given and the advantages of the pulse-optical transmission systems for transmitting very simple signals, e.g., switching commands, are discussed. (*In German.*) Die Signalübertragung mit Lichtimpulsen. ***Frank Früngel and Gerhard Hands.*** *Archiv der Elektrischen Übertragung*, v. 13, Mar. 1959, p. 121-131.

9007* "Echostant" Matching—a New Method of Matching Image Parameter Filters. Describes a new method of matching image parameter filters to the load impedances. Advantages of this type of matching are compared with the use of simple *m*-derived image impedances. (*In German.*) Echostantanpassung eine neue Methode zur Anpassung von Spiegelparameterfiltern. ***Torbern Laurent.*** *Archiv der Elektrischen Übertragung*, v. 13, Mar. 1959, p. 132-140.

9008 Miniature Movies of the Planets. Discusses the first space probes which are likely to employ scanning systems that more closely resemble miniature computers than present-day TV equipment to make composite images of the moon and nearer planets. ***Stuart C. Baker and John M. Kelso.*** *Astronautics*, v. 4, May 1959, p. 26 + 4 pages.

9009 A 960-mc Lunar Transmitter. Discusses the design of high-efficiency, minimum-weight UHF transmitters for communicating with space vehicles at great ranges. ***Leonard R. Malling.*** *Astronautics*, v. 4, May 1959, p. 29 + 3 pages.

9010 Micromodules Make Their Bow. A closer look at the tiny encapsuled electronic systems which, offering a parts density of 250,000 per cu ft, may significantly reduce payload sizes and weights. ***H. J. Laiming and J. W. Knoll.*** *Astronautics*, v. 4, May 1959, p. 34 + 3 pages.

9011 Microminiaturization in a Space Vehicle Frequency Standard. Modular microminiaturized components meet military design requirements while offering flexibility for space vehicle applications, both in function and precision manufacturing. ***Patrick E. Lannan.*** *Astronautics*, v. 4, May 1959, p. 40 + 2 pages.

9012 Beyond Microminiaturization: Integrated Electronics. Research on microminiaturized multipurpose components employing inhomogeneous solid-state materials may lead to space age electronic systems that will rival the human brain in complexity, volume, and power consumption. ***Harry Kihn.*** *Astronautics*, v. 4, May 1959, p. 44 + 4 pages.

9013 What Price Microminiaturization? Discusses whether adequate propulsion capability or microminiaturization of the size and weight of payload packages may provide a more reliable and less costly means of carrying out many major space missions. ***David A. Young.*** *Astronautics*, v. 4, May 1959, p. 46 + 2 pages.

9014* Mechanized Assembly of Grown Junction Transistors. Describes a duplex rotary machine designed to take over several delicate operations in the automatic assembly of grown junction transistors. ***R. C. Shafer.*** *Automation Progress*, v. 4, Apr. 1959, p. 116 + 5 pages.

9015 Military Electronic Developments and Their Applications. ***D. A. Quarles.*** *Electrical Engineering*, v. 78, May 1959, p. 435-448.

9016 The Transformation of Electronic Communications. ***E. W. Engstrom.*** *Electrical Engineering*, v. 78, May 1959, p. 462-470.

9017 Using Unusual Semiconductors. Only germanium and silicon of the many semiconductors have been exploited. Possible advantages of going to unusual materials, especially compounds, are presented and studied. It appears that work on such semiconductors could be well worth while. ***Harold L. Armstrong.*** *Electronic Industries*, v. 18, May 1959, p. 90 + 6 pages.

9018 Zero-Crossing Technique Syncs Wavetrain Outputs. Sinusoidal wavetrain output starting at the zero crossing of a sine wave is produced by a gating circuit. This wavetrain generator is used to determine characteristics of ultrasonic delay lines and other ultrasonic equipment. ***John A. Wereb, Jr.*** *Electronics*, v. 32, no. 19, May 8, 1959, p. 64-65.

9019 Using TV Techniques in Astronomy. Unique flying-spot-type closed-circuit television system compares two photographs and displays any difference between them. Several non-astronomical uses are also suggested. ***J. Borgman.*** *Electronics*, v. 32, no. 19, May 8, 1959, p. 66-68.

9020* Coupling of Lines for Carrier Frequency Transmission Along High Tension Lines. Discussion of the transmission of communications by: (1) a telephone line using the supports of a high tension line; (2) a carrier frequency using the high tension line itself; and (3) a carrier frequency using an insulated earth wire of high tension lines. (*In German.*) Die Leitungsankopplungen für die trägerfrequente Übertragung längs Hochspannungsleitungen. ***R. Baranowsky.*** *Energietechnik*, v. 9, no. 3, Mar. 1959, p. 110-116.

9021* Quebec-Labrador Tropospheric Scatter Radio System. This paper is a report of the engineering and construction of the project with particular emphasis on the broad planning of the system and on the construction aspects. ***D. J. McDonald and C. E. Frost.*** *Engineering Journal*, v. 42, Apr. 1959, p. 43-57.

9022 Fifth National Symposium on Reliability and Quality Control in Electronics. 451 pp. 1959. Institute of Radio Engineers, New York. (TK7801 N21p Over.)

9023 How to Design and Specify Printed Circuits. This book embodies the collective knowhow of pioneer firms in the manufacture of printed wiring devices with respect to manufacturing experience on thousands of circuit applications. Its purpose is to assure success of new applications and minimize engineering and manufacturing errors by presenting sound and simple methods of design and specification. Sponsored by the Institute of Printed Circuits. 92 pp. The Institute of Printed Circuits, Chicago. (TK7870 In7h)

9024 High-Speed Low-Level Scanner. Describes the design and working characteristics of a high-speed low-level scanner which scans 500 pairs of strain-gage inputs at a repetition rate of 50 pairs per second, under control of a train of control pulses. A minimum dwell time of 5 msec is needed. The output of this scanner is to be connected to a high-speed digital voltmeter. ***Kurt Enslein.*** *IRE Transactions on Instrumentation*, v. I-8, Mar. 1959, p. 3-7. (TK1 In6.6i Vis.)

9025 Basic Theory of Locked Oscillators in Tracking FM Signals. Reviews the theory of phase-locked oscillator (PLO) loops as used for tracking frequency modulated carriers in the presence of noise and of other interfering signals such as may occur in multichannel telemetering systems. The design and synthesis of PLO circuits from systems specifications is discussed. ***Glenn W. Preston.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-5, no. 1, Mar. 1959, p. 30-32. (TK1 In6.6r Vis.)

9026 A New Era in Communications Through Transistors. The transistor and its application of the two-way communication field. ***William J. Weisz.*** *IRE Transactions on Vehicular Communications, PGVC-12*, Apr. 1959, p. 35-46. (TK1 In6.6v Vis.)

9027 Semiconductors: a Dynamic New Industry. Continuous growth of the electronics industry depends upon developing more complex systems and then solving the acute problems arising from maintenance of such systems. *Industrial Research*, v. 1, no. 1, Jan. 1959, p. 72 + 4 pages.

9028* A Three-Frequency Electron Beam Parametric Amplifier and Frequency Converter. The work done by Louisell and Quate (1958) has been generalized to the case of a beam in which the pump frequency does not have to be twice the signal frequency. The effect of the beam size on the gain is studied and the Manley-Rowe relations are verified. ***W. H. Louisell.*** *Journal of Electronics and Control*, v. 6, no. 1, Jan. 1959, p. 1-25.

9029* On Space Charge Waves. The existence is shown in four sets of space charge waves on a uniform electron beam focused by an axial magnetic field with arbitrary, but uniform cathode flux. Expressions for the plasma frequency reduction figures are given. Some discussion is given for the case of a beam in a propagating drift tube. ***D. H. Trevena.*** *Journal of Electronics and Control*, v. 6, no. 1, Jan. 1959, p. 50-64.

9030* A Comparison of the Theory of Impact Ionization With Measurements on Silicon p-n Junctions. Armstrong's equations for the generation rate of electrons and holes by impact ionization in step p-n junctions at voltages where the effect of multiplication is negligible are compared with current-voltage characteristics measured on alloyed Si p-n junctions. ***F. W. G. Rose.*** *Journal of Electronics and Control*, v. 6, no. 1, Jan. 1959, p. 70-73.

9031 Effect of Thermal Expansion of the F_2 Region of the Ionosphere on the Absorption of High Frequency Radio Waves. Describes the experimental procedure used and the results obtained in the measurement of the total absorption of radio waves in the ionosphere by the pulse technique at vertical incidence at different hours of the day. ***S. K. Sharma.*** *Journal of Scientific & Industrial Research*, v. 18A, Jan. 1959, p. 17-20.

9032* Measurement & Description of the Characteristics of Atmospheric Radio Noise. A tentative answer to the question: What are the most easily measured characteristics of terrestrial radio noise from which the interference to different types of communication systems can be determined? ***S. V. Chandrashekhar Aiya.*** *Journal of Scientific & Industrial Research*, v. 18B, Feb. 1959, p. 43-47.

9033* Atmospheric Radio Noise Levels at Poona in the 2.5-20 Mc/s. Band. Noise data in a form which includes both the amplitude and time characteristics of atmospheric radio noise are presented. The actual numerical data pertain to Poona (18.31N, 73.55) for the time block 1800-2400 hrs IST and for the frequency band 2.5-20 Mc/s. ***S. V. Chandrashekhar Aiya, K. R. Phadke, S. V. Padmanabhan, and C. K. Sane.*** *Journal of Scientific & Industrial Research*, v. 18B, Feb. 1959, p. 47-53.

9034* Atmospheric Noise Interference in the Standard Broadcast Band at Poona. A report of some of the investigations carried out at Poona (18.31N, 73.55E) on atmospheric radio noise in the standard broadcast band (0.535-1.605 Mc/s.) are presented. A possible way of noise estimation is described and the actual estimates compared with measured values. ***S. V. Chandrashekhar Aiya and C. G. Khot.*** *Journal of Scientific & Industrial Research*, v. 18B, Feb. 1959, p. 54-66.

9035 Military Transistor Applications. Discusses trends in the application of transistors in modern military equipment. ***J. A. Baird.*** *Military Electronics*, v. 6, Apr. 1959, p. 7-10.

9036 RCA Demonstrates Solar Cell Using Gallium Arsenide. A new match-size solar cell which uses a high-temperature compound called gallium arsenide to transform light into heat has been developed. It holds great promise for use in space vehicles. When light is focused on the surfaces of the solar cells, electricity is generated and fed to the transmitter. The transmitter consists of a coil, a capacitor and a new electron device, the "tunnel" diode, which is also made of gallium arsenide. *Missiles and Rockets*, v. 5, no. 19, May 11, 1959, p. 16.

9037* Teletransmission of Radiological Images. Interest and Present State of the Problem. Improvement of the radioscopic picture obtained by means of amplifiers based on the acceleration in vacuum of the element of the electronic beam after crossing the area to be X-ray examined in daylight. These devices are the brightness amplifier, the artificial eye, the "vidicon" and the "orthicon". Individual performance and future perspective. (*In French.*) Téléransmission des images radiologiques. Intérêt et état actuel de la question. ***M. Noix.*** *Revue Générales des Sciences Pures et Appliquées*, v. 66, nos. 1-2, Jan.-Feb. 1959, p. 23-28 + 2 plates.

9038 Semiconductors. A reference book on the physical chemistry and fundamental physics of semiconductors, with detailed analyses of important semiconductor materials. The chemical aspects and the physics of semiconductor behavior are exhaustively treated. ***N. B. Hannay, editor.*** 767 pp. 1959. Reinhold Publishing Corp., New York. (TK7872.S4 H19s)

9039 The Prediction of Ballistic Missile Trajectories From Radar Observations. A study of methods for predicting properties of a ballistic missile trajectory. The predictions are based on information obtained from radar observations of the missile. With very slight modifications, the methods developed can be used to estimate parameters of satellite orbits. ***I. I. Shapiro.*** 208 pp. 1958. McGraw-Hill, New York. (UG630 Sh22p)

See also: **8601** (electronic applications in space vehicles); **8602** (guided missile systems); **8694** (thermoelectric devices); **8711** (SiC semiconductors); **8985** (basic and applied engineering research); **9218** (infra-red sensing element); **9227** (pulse-height discriminator); **9641** (semi-conductor optical properties).

ENGINEERING ECONOMICS

9040* The Pattern of Consumer Purchases. This article shows how data on purchases of non-durable consumer goods can be fitted by the negative binomial distribution, and discusses applications of this finding. ***A. S. C. Ehrenberg.*** *Applied Statistics*, v. 8, no. 1, Mar. 1959, p. 26-41.

9041 Britain and Europe. A Study of the Effects on British Manufacturing Industry of a Free Trade Area and the Common Market. Presents the findings of a survey, made in 1957, sponsored by the "Britain and Europe Fund", and gives the effects to be expected in individual industries from the adoption of the "Free Trade Area" agreement by Great Britain. 302 pp. 1957. The Economist Intelligence Unit Limited, Washington, D. C. (HD9731 Ec74b)

9042* Seaway Ports Prepare for New Waterborne Traffic Patterns. Cautious optimism replaces widespread enthusiasm as U. S., Canadian port officials await effects of Seaway. Belief is that, in first years, bulk cargoes will show greatest growth, general cargo will develop more slowly. ***H. G. Cochrane.*** *Canadian Business*, v. 32, May 1959, p. 28 + 15 pages.

9043 Merger: Watch the Pitfalls. An attempt is made here frankly to present some generalities in the hope that they may contribute to the preplanning efforts of companies who are now contemplating the relative merits of diversification and/or acquisition as part of their future. Every company has its own highly individual set of problems. There can be no universal prescription. This discussion brings out at least some of the complexities, emphasizes advance planning, and explains why, as one old hand puts it, "mergers never turn out as easy as they look". ***Lauren B. Hitchcock.*** *Chemical and Engineering News*, v. 37, no. 18, May 4, 1959, p. 66 + 5 pages.

9044 Your Stake in the Materials Revolution. Materials problems, the most crucial obstacles to technical progress, are being solved today on a scale and at a pace never before attained in industry. Unfortunately, according to leading industrial observers, 90% of American manufacturers maintain a defensive position towards new materials and have to be pushed into using them. This inertia, which limits profits and sales volume, prevails despite the fact that today it is easier than ever before to employ new materials effectively. ***Melvin Mandell, editor.*** *Dun's Review and Modern Industry*, v. 73, no. 5, May 1959, p. 48-50.

9045 Corporate Size as Company Presidents See It. Is small business being stifled by the corporate giants? Here's important evidence on this question, straight from the presidents of 104 big and 121 smaller industrial companies participating in a new DR&MI survey. ***Kenneth Henry.*** *Dun's Review and Modern Industry*, v. 73, no. 5, May 1959, p. 51 + 8 pages.

9046 When Should You Make It Yourself? Few companies can afford to decide vital make-or-buy decisions on the basis of cost-comparison formulas alone. Long-term company goals are involved, too. Here's a rundown on the practical, yet farsighted, approach that has been evolved by American Motors. ***Roy Chapin, Jr.*** *Dun's Review and Modern Industry*, v. 73, no. 5, May 1959, p. 54 + 3 pages.

9047 The Growing Challenge of Foreign Competition. A report on an interview with General Edmond H. Leavey, head of International Telephone and Telegraph Corp. *Dun's Review and Modern Industry*, v. 73, no. 5, May 1959, p. 62 + 5 pages.

9048 Economics of American Forestry. Furnishes the tools and techniques of analysis for investigating the economic relationships which exist in forestry. Surveys the whole field of forestry economics, but first introduces simple concepts of the economic theory to prepare the way for the more complex principles that influence forestry problems and situations. ***Albert C. Worrell.*** 441 pp. 1959. John Wiley & Sons, New York. (SD393 W89e)

9049 Oil in the Western Hemisphere. This article is concerned with possible future trends. Vital public policy questions are involved. There are important implications not only for private oil companies but for all United States investors and sellers in Latin America—as well as for our whole economy, which lives on oil. ***Clifford Frank Owen.*** *Harvard Business Review*, v. 37, no. 3, May-June 1959, p. 61-71.

9050 An Oscilloscopic View of the Electronic Industry by Investment Capital. An investment analyst explains how the securities of the electronics industry are appraised. ***Casper M. Bower.*** *IRE Transactions on Engineering Management*, v. EM-6, no. 1, Mar. 1959, p. 1-8. (TK1 In6.6em Vis.)

9051 Your Dollar Returns From Research. Latest surveys show how research has paid off in profits for your competitors, the percentages they spend for research, their attitudes toward

it. To be effective, research programs must be continuous. They must never be a function of fluctuating sales. ***Irving Telling and Warren S. Berg.*** *Industrial Research*, v. 1, no. 1, Jan. 1959, p. 77-82.

9052* Reasons Used by Corporations to Justify Leasing of Trucks and Automobiles. The study indicates that the majority of the companies studied based their decision to lease on the fact that it provided a source of capital, and either did not actually know or were rather unconcerned with what such capital cost. It also appears that in many cases companies might find it profitable to consider other sources of capital for financing motor vehicle fleets, and to make comparative cost studies of the different sources. ***E. Paul DeGarmo and Joseph F. Rodgers.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 152-154.

9053* Planning Business Progress. A study of the patterns underlying business profits and progress was touched off by loss of market position and profit. The problem was to discover patterns in our technologically advanced economy which would give top management a new basis for planning profit. Useful insights were gained, particularly on the acceleration in idea production and productivity and on the character of the innovation cycle and its relation to employment, investment, and profitability. A model is built which corrects certain errors in Parkinson's law and Keynes theory. ***Melvin E. Salveson.*** *Management Science*, v. 5, no. 3, Apr. 1959, p. 217-237.

9054* Long-Range Planning. Challenge to Management Science. This paper attempts to define long-range planning as the organized process of making entrepreneurial decisions. It tries to answer three questions asked by managers and management scientists when they hear the phrase "long-range planning": what long-range planning is and what it is not; why it is needed; and what is needed to do long-range planning. ***Peter F. Drucker.*** *Management Science*, v. 5, no. 3, Apr. 1959, p. 238-249.

9055* Columbium: Is it Headed for a Boom? Don't expect much growth in columbium's market until the price falls to $15 per pound. This is far below the present price and the predicted price level attainable in 1959 ($50 per pound). Even at the $15 level, production of Cb probably will not amount to much more than a semi-works scale, i.e., 20 to 40 tons per month. If the price drops to the $4 to $6 range, the market for Cb will show amazing growth, say the optimists. Despite these disadvantages, the future for Cb looks promising. Too many responsible officials are forecasting a growth for the metal to dismiss Cb as another flash-in-the-pan. *Mining World*, v. 21, no. 6, May 1959, p. 38-41.

9056* Profit Management Through Cost Control. Profits can and should be planned for. If the plan is to be realized, manufacturing costs must be controlled. Cost control is a frame of mind; to be successful it must have top management support. ***R. B. Hill.*** *Modern Castings*, v. 35, May 1959, p. 75-78.

9057 National Economy of the USSR, 1956. Statistical Yearbook. This statistical year book contains very important data which reflect the development of the USSR national economy in 1956 as compared with prewar years of 1928 and 1940, and with prerevolutionary 1913. 297 pp. 1956. Central Statistical Administration Under The Council of Ministers, USSR.

9058* Energy, Economy, and Society in Transition. Discusses the economic effects of the use of nuclear energy throughout the world. ***Boris Pregel.*** *New York Academy of Sciences, Transactions*, v. 21, no. 3, Jan. 1959, p. 206-219.

9059* Brownian Motion in the Stock Market. It is shown that common-stock prices, and the value of money can be regarded as an ensemble of decisions in statistical equilibrium, with properties quite analogous to an ensemble of particles in statistical mechanics. ***M. F. M. Osborne.*** *Operations Research*, v. 7, no. 2, Mar.-Apr. 1959, p. 145-173.

9060 Reports on the Productive Uses of Nuclear Energy. Nuclear Energy and the U. S. Fuel Economy, 1955-1980. An informative projection of the nation's total energy position and of the prospective economic relationships that may develop among the sources of energy available in the United States representing a contribution to public understanding of the probable cost trends of conventional fuels, the extent to which nuclear energy can supplement conventional energy resources, and the degree of urgency attaching to various ways of expanding our energy capabilities. ***Perry D. Teitelbaum.*** 188 pp. 1958. National Planning Association, Washington, D. C. (HD9698.U5 T23n)

9061 Explanation and Prediction in Economics. The basic statements of economics may serve to explain the past but not to predict the future. Economists construct models, not theories. Their models may be confirmed by reference to empirical data, but they cannot be refuted. Therefore, they are strictly explanatory in character. ***Andreas G. Papandreou.*** *Science*, v. 129, Apr. 24, 1959, p. 1096-1100.

9062* The Developing Market in Men's Cosmetics in the United States of America. The growth in the sales of men's cosmetics is summarized and product types are detailed. ***J. R. L. Martin.*** *Society of Cosmetic Chemists, Journal*, v. 10, no. 1, Jan. 1959, p. 20-31.

9063 The Chemical Industry in Europe. This report deals with the situation during 1957 and the first six months of 1958. Part I gives a general survey of demand, supply, investments, price developments and international trade. Part II studies the trends of Member countries taken individually. Part III contains nine more detailed studies of the principal sectors of the industry—basic chemicals, petroleum chemicals, dyestuffs, paints and varnishes, soaps and detergents, fertilizers, plastics materials, sulfurous materials, and photographic film and plate. Statistics of production and trade are annexed to the report. 203 pp. 1959. The Organisation for European Economic Co-Operation, Paris. (HD9656 Or4c)

9064 The Network of Intra-European Trade: Trade by Product in 1957. The publication last year of "The Network of Intra-European Trade: Trade by Product in 1956" (now in second edition) filled an evident need for a volume presenting the available data on intra-European trade in as handy and complete a form as possible. This new volume gives the corresponding data for 1957, bringing up-to-date the pattern of trade within the "common market" and the proposed "free trade area". 217 pp. 1958. Organisation for European Economic Co-Operation, Paris. (HF3491 Or3s Over.)

See also: **9353** (Al die-casting metal costs).

FLUID MECHANICS

9065* Steady Relativistic Gas Flows With Axial Symmetry (Vortex Case). (*In Russian.*) Ustanovivshiesia relativistskie techeniia gaza s osevoĭ simmetrieĭ (vikhrevoĭ sluchaĭ). ***A. Arynov.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 3, Mar. 21, 1959, p. 512-514.

9066* On the Theory of Locally Isotropic Turbulence. More accurate usual results and new ones were obtained by this new approach in the case when, for the values of the relative velocities and varieties on any final amount of points, the distributions of the probabilities were determined independently from time. (*In Russian.*) K teorii lokal'no-izotropnoĭ turbulentnosti. ***A. S. Monin.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 3, Mar. 21, 1959, p. 515-518.

9067* Liquid Phase Resistance in Water Cooling. A liquid film resistance is shown to exist, but is shown to be negligible for practical design purposes of direct contact coolers. ***G. Cribb.*** *British Chemical Engineering*, v. 4, May 1959, p. 264-266.

9068* A Study on Non-Newtonian Flow in Pipe Lines. The laws of similarity with respect to the non-Newtonian flows through pipe lines by using the equations of motion were found, the Fanning's formula of pressure losses in pipe lines was extended, and the coefficients of pipe friction losses for turbulent flows were evaluated. When the coefficient of pipe friction and the Reynolds number in a wider sense are used, the characteristics of non-Newtonian flows in pipe lines are approximately equal to those of Newtonian flows. ***Yukio Tomita.*** *Bulletin of JSME*, v. 2, no. 5, Feb. 1959, p. 10-16.

9069 Better Way to Trace Liquid Flow Patterns. Suspended fluorescent particles lighted with UV give fine photos. You can make your own of any density by methods given here. ***Merton Allen.*** *Chemical Engineering*, v. 66, May 4, 1959, p. 148 + 1 page.

9070* Effect of the Passage of Linear Plane Swell Upon a Threshold. Case of a prismatic obstacle with a rectangular cross-section fully immersed and resting with its surface on the horizontal bottom of a channel. (*In French.*) Effet de passage d'une houle linéaire plane sur un seuil. ***Kenzo Takano.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 12, Mar. 23, 1959, p. 1768-1781.

9071* Experimental Realization of a Practically Infinite Medium Under Unsteady Conditions. (*In French.*) Sur la réalisation expérimentale d'un milieu pratiquement infini en régime non permanent. ***Étienne Crausse and Yves Poirier.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 13, Apr. 1, 1959, p. 1923-1925.

9072* Visco-Elastic Properties of Snow and Ice in Greenland Ice Cap. *Ukichiro Nakaya.* *Hokkaidô University. Faculty of Science, Journal*, v. 5, Ser. II. Physics, no. 3, July 1958, p. 119-163 + 6 plates.

9073* The Dispersal of Turbulent Flows in Liquids and Gases. A general relationship is found which characterizes free turbulent flow of various forms dispersing in a stationary medium. Taking into account the change of momentum in the flow, these relationships are applied to vortices and to flows propagated in a limited space. (*In Russian.*) O rasprostranenii turbulentnykh struĭ zhidkosteĭ i gazov. ***Iu. F. Kuvaev.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 2, no. 4, Apr. 1959, p. 21-27.

9074 Microwave Absorption and Molecular Structure in Liquids. XXVI. The Dielectric Relaxation Times of Two Large Oblate Ellipsoidal Molecules in Benzene Solution. *Donald A. Pitt and Charles P. Smyth.* *Journal of Physical Chemistry*, v. 63, Apr. 1959, p. 582-587.

9075* Heat Transfer in Laminar Flow Through a Tube. The problem is studied under the assumption that there is a parabolic distribution of velocity. The solution, obtained by the method of least squares, is represented in terms of a set of nonorthogonal characteristics functions. Asymptotic developments are obtained which are useful in the limiting cases. ***Milton Abramowitz, William F. Cahill, and Clarence Wade, Jr.*** *Journal of Research, National Bureau of Standards*, v. 62, no. 3, Mar. 1959, p. 101-105.

9076 Selecting Hydraulic Tubing. Specification principles; available tubing types and materials; selection and application practices. ***Jaroslav J. Taborek.*** *Machine Design*, v. 31, May 14, 1959, p. 189-194.

9077* Fitting an Equation to the Flow of Lubricating Greases in Viscometers and Pipes. The flow of lubricating grease over the wide shear-rate range of 10^{-5} to 10^{5} reciprocal seconds can be simply and accurately described by an equation. It has been successfully applied to data from capillary viscometers, a cone-and-plate viscometer, and pipes. ***A. W. Sisko, L. C. Brunstrum, and R. H. Leet.*** *NLGI Spokesman*, v. 23, no. 2, May 1959, p. 57-61.

9078* Heavy Crude: Next Pipeline Conquest? Water injection tests this summer may show the way to more economical pipeline movement of "black oils". *Petroleum Week*, v. 8, no. 18, May 1, 1959, p. 44-45.

9079 Onset of Convection in Liquids Subjected to Transient Heating From Below. Experimental studies of the onset of natural convection in liquids subjected to heating from below while insulated above. ***Robert K. Soberman.*** *Physics of Fluids*, v. 2, no. 2, Mar.-Apr. 1959, p. 131-138.

9080* Thermal Instability of Viscous Fluids. The stability of a viscous fluid in an insulated vertical tube or between insulated vertical planes when a negative temperature gradient is maintained in the upward direction depends on the magnitude of this gradient, the gravity, the geometry of the solid boundary, the properties of the fluid, and the wave length of the disturbance. Presents the relationships between these variables for neutral stability, and the results concerning the effect of rotation on stability. ***Chia-Shun Yih.*** *Quarterly of Applied Mathematics*, v. 17, no. 1, Apr. 1959, p. 25-42.

9081 On the Foundations of Linear Isotropic Visco-Elasticity. The properties of a linear visco-elastic material are developed from the hypothesis that the microscopic structure of such a material is mechanically equivalent to a network of elastic and viscous elements. ***D. R. Bland.*** *Royal Society, Proceedings*, v. 250, ser. A, Apr. 7, 1959, p. 524-549.

9082 Wave-Riding Dolphins: How Do They Do It? At present only the dolphin knows the answer to this free-for-all in hydrodynamics. ***P. F. Scholander.*** *Science*, v. 129, Apr. 24, 1959, p. 1085-1087.

9083 Determination of Liquid Velocity by Measuring Its Electric Resistance. An experimental installation specially developed for measuring low velocities of streaming liquids by the so-called "salt cloud" method. (*In Czech.*) Zjištění rychlosti kapaliny metodou měření elektrického odporu. ***V. Valtera and V. Libich.*** *Strojírenství*, v. 9, no. 3, Mar. 1959, p. 226-227.

9084* An Apparent Viscosity for Use in the Application of Reynolds Numbers to the Flow of Dilute Pulp Suspensions. Description of a generalized Reynolds number equation that is applicable to non-Newtonian as well as Newtonian fluids. The experimental data prove the validity of this equation and show a relationship between per cent consistency of pulp slurries and apparent viscosity which is applicable when the generalized Reynolds equation is used. ***W. E. Guthrie.*** *Tappi*, v. 42, Mar. 1959, p. 232-235.

9085 The Effect of High Constant Pressure Sound Fields on Free Convection Heat Transfer From a Horizontal Cylinder. Experimental evidence is given that heat transfer may be increased by more than 100% in the presence of sound fields. The heat transfer coefficient did not increase until the sound pressure level reached 134 db. ***Jack P. Holman and Tipton P. Mott-Smith.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 58-352, Dec. 1958, 54 pp. (TL507 Un3.18t Contin.)

9086 Flow Properties of Bulk Solids. Description of the measure of flowability of bulk solids, the testing apparatus and procedure used in measurements, and discussion of the results obtained for a few bulk solids. ***A. W. Jenike, P. J. Elsey, and R. H. Woolley.*** *Utah Engineering Experiment Station, Bulletin No.* 95, Dec. 1958, 51 pp. (QE169 Ut1.82b Vis.)

9087 Flow of Bulk Solids Progress Report. Mathematical concept of a bulk solid, flow properties of bulk solids, and their measurement, design criteria of storage plant, relation between flow properties and design criteria. ***A. W. Jenike, P. J. Elsey, and R. H. Woolley.*** *Utah Engineering Experiment Station, Bulletin No.* 96, Dec. 1958, 31 pp. (QE169 Ut1.82b Vis.)

9088* Influence of the Free Motion on the Heat Transmission Factor in a Flow Around a Sphere in the Region of Small Reynold's Numbers. Investigation of theoretical solution of the problem on the heat transmission in mixed convection. The solution is compared with experimental data. Formulas are submitted for the summary heat transmission factor by convection in a flow around a sphere in the field of a small Re number. (*In Russian.*) Vliianie svobodnogo dvizheniia na koeffitsient teplootdachi pri obtekanii shara oblasti malykh chisel Reĭnol'dsa. ***L. I. Kudriashev and A. Ia. Ipatenko.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 24, no. 3, Mar. 1959, p. 309-318.

See also: **9636** (liquid He).

FOOD TECHNOLOGY

9089* Production of Flavor in Cured Meat by a Bacterium. A species of *Pseudomonas* growing in a meat curing brine affected flavor. Methods are described for evaluating microorganisms for flavor production in meat curing brines in a completely controlled system. ***Ruth A. McLean and W. L.***

Sulzbacher. *Applied Microbiology*, v. 7, no. 2, Mar. 1959, p. 81-83.

9090 Food Industries Manual. A technical and commercial compendium on the manufacture, preserving, packing and storage of all food products. ***W. B. Adam, et al., compilers.*** 979 pp. 1958. Chemical Publishing Co., Inc., New York. (TP370 F73i18)

9091* Commercial-Scale Evaporation of Tomato Products in Flash Evaporators. ***A. I. Morgan, T. Wasserman, A. H. Brown, and G. S. Smith.*** *Food Technology*, v. 13, Apr. 1959, p. 232 + 3 pages.

9092 Essential Fatty Acids as Food Supplements. Use of additives to improve nutritional status of foods. ***E. Aaes-Jorgensen.*** *Journal of Agricultural and Food Chemistry*, v. 7, Apr. 1959, p. 246-249.

9093* Studies on the Inhibition of Growth of an Implanted Fibrosarcoma in Rats. The Effect of Fat in the Diet With and Without Injections of Guinea Pig Serum. ***Eloise Jameson, R. Mark Ryan, and Philip I. Kramer.*** *Journal of Nutrition*, v. 67, no. 3, Mar. 1959, p. 469-482.

9094* Biological Availability of Essential Amino Acids to Human Subjects. I. Whole Egg, Pork Muscle and Peanut Butter. ***Johnnie H. Watts, et al.*** *Journal of Nutrition*, v. 67, no. 3, Mar. 1959, p. 483-496.

See also: **8731** (surfactants in food processing); **9273** (aluminum food cans).

FUELS AND COMBUSTION

9095* The Pulsating and Spin Detonation of Gas Mixtures in Pipes. The complex formed by the wave structure of the detonation is unstable and to this is due the localization of the chemical reaction in separate parts of the front of the detonation wave. (*In Russian.*) Pul'siruiushchaia i spinovaia detonatsiia gazovykh smesei v trubakh. ***Iu. N. Denisov and Iu. K. Troshin.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 1, Mar. 1, 1959, p. 110-113 + 1 plate.

9096* Brown-Coal Char as a Fuel for Foundry Cupolas. Following the successful production of a hard lump char by the carbonization of brown-coal briquettes at the University of Melbourne, attention has been given to the possible use of the char as a fuel for foundry cupolas. The char combines a high chemical reactivity with a physical strength sufficiently high to permit it to be used in normal cupola practice. Melting trials show promise. ***D. G. Evans, R. S. Higgins, and G. L. Kennedy.*** *British Foundryman*, v. 52, Apr. 1959, p. 171-183.

9097* The Design and Performance of Boiler Stokers. I. Mechanical Stokers for Shell Boilers. Summarizes factors which characterize the several types of stokers and indicates the aspects that influence choice, with particular reference to available fuels. ***J. N. Williams.*** *Coke and Gas*, v. 21, Apr. 1959, p. 142-146.

9098* Integrating Coal Properties With Boiler Design. Tallies and describes the design areas under influence of the various characteristics we now test for in coal purchases. ***Douglas G. Hubert.*** *Combustion*, v. 30, no. 10, Apr. 1959, p. 38-45.

9099* The Cracking of Hydrocarbons in Conventional Furnace Plants and Its Significance for Gas Supply. Operation of, and results obtained with, the new DOG compartment generator. Together with a full gasification of coal this installation can crack hydrocarbons. (*In German.*) Spaltung von Kohlenwasserstoffen in Ofenanlagen der klassischen Gaserzeugung und ihre Bedeutung für die Gasdarbietung. ***Karl Ristow.*** *GWF: Gas- und Wasserfach (Gas)*, v. 100, no. 15, Apr. 10, 1959, p. 354 + 8 pages.

9100 Carbon Formation in an Acetylene—Air Diffusion Flame. The rate of soot issue from an acetylene–air diffusion flame has been measured as a function of pressure and air/fuel ratio. The soot has been analyzed for soluble and volatile constituents by infrared and ultraviolet absorption spectroscopy and mass spectrometry. The rate measurements can be explained on the basis of a soot formation rate which varies linearly with pressure and is independent of air/fuel ratio. Analysis is included. ***M. E. Milberg.*** *Journal of Physical Chemistry*, v. 63, Apr. 1959, p. 578-582.

9101* Domestic Solar Water Heater. Describes an arrangement for heating water with solar energy to supply the domestic needs of a small family at Delhi, using galvanized iron sheets as construction material. ***K. N. Mathur, M. L. Khanna, T. N. Davey, and S. P. Suri.*** *Journal of Scientific & Industrial Research*, v. 18A, Feb. 1959, p. 51-58.

9102* Principal Development Trends of Modern Rocket Fuels. The desirable characteristics of fuels and fuel combinations are reviewed, particular attention being paid to the light elements. Possibilities afforded by liquid fuels and their combinations are outlined, with reference to borane and hydrazine in particular, relevant to increase in specific impulse. Certain improvements in this respect are additionally obtainable with solid fuels. Comment on the free radical as rocket fuel and on nuclear rockets. Concluding remarks indicate possible trends of development. (*In German.*) Hauptlinien der Entwicklung neuzeitlicher Raketentreibstoffe. ***A. Dadieu.*** *Luftahrttechnik*, v. 5, Apr. 1959, p. 123-130.

9103 High-Speed Gas Burners. New flame-retention burner makes flames behave under adverse combustion conditions. ***R. A. Jacobson.*** *Machine Design*, v. 31, May 14, 1959, p. 22-25.

9104 Index of Oil-Shale and Shale-Oil Patents: 1946-56. A Supplement to Bulletins 467 and 468. I. United States Patents. II. United Kingdom Patents. ***Simon Klosky, compiler.*** *U. S. Bureau of Mines, Bulletin* 574, 1958. I. 134 pp. II. 75 pp. (TN21 Un3b Vis.)

9105 Use of Sole-Heaed Oven for Studies of Coal Expansion and Coke Formation. Principal findings of a special investigation on the oven. ***J. B. Gayle and W. H. Eddy.*** *U. S. Bureau of Mines Report of Investigations* 5464, 1959, 35 pp. (TN21 Un3r Vis.)

9106* Experience With Lignite Furnaces. A panel discussion. (*In German.*) Erfahrungen mit Braunkohlenfeuerungen. *Vereinigung der Grosskesselbesitzer, Mitteilungen*, no. 59, Apr. 1959, p. 67-125.

See also: **9614** (molecular sieves for natural gas treatment).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

9107* Quantity Distribution of Zoöplankton in the South Pacific. Results of zoöplankton research in relation to qualitative and quantitative characterization of plankton, the appearance of large plankton masses used as food by whales, the zöogeographical distribution of surface waters according to species-indicators in plankton. (*In Russian.*) Kolichestvennoe raspredelenie zooplanktona v iuzhnoi chasti tikhogo okeana. ***A. G. Naumov.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 3, Mar. 21, 1959, p. 621-624.

9108* A Structural Study of Iddingsite From New South Wales, Australia. Iddingsite is polycrystalline and consists of goethite and a layer lattice silicate. In the alteration of olivine to iddingsite the original lattice of close-packed oxygens appears not to have been greatly disturbed and the changes have occurred by the movement of cations within small regions to form microcrystals of the alteration products. The parallel alignment of the components explains why it behaves optically as a single crystal. ***G. Brown and I. Stephen.*** *American Mineralogist*, v. 44, nos. 3-4, Mar.-Apr. 1959, p. 251-260.

9109* On the Hydrates of Sodium Carbonate, a Correction, and the Crystallography of Trona. Reexamination of material earlier described as the hemipentahydrate of sodium

carbonate, $Na_2CO_3 \cdot 2\frac{1}{2}H_2O$, proves it to be $Na_3H(CO_3)_2 \cdot 2H_2O$, trona. A new setting of trona is based on the cell dimensions a_o 20.11Å, β_o3.49, c_o 10.31, β 103°8′ space group I2/c. ***A. Pabst.*** *American Mineralogist*, v. 44, nos. 3-4, Mar.-Apr. 1959, p. 274-281.

9110* The Origin of the Vermiculite Deposit at Libby, Montana. The ore body lies in an augite pyroxenite, which has been altered to biotite, hydrobiotite, and vermiculite. Numerous syenite dikes may be observed in the pyroxenite. Concludes that augite altered to biotite at the time of the intrusion of the syenite dikes, and that the biotite was altered to hydrobiotite and vermiculite by supergene solutions. ***William A. Bassett.*** *American Mineralogist*, v. 44, nos. 3-4, Mar.-Apr. 1959, p. 282-299.

9111* A Restudy of Stevensite and Allied Minerals. A restudy shows that it is not an interlayered talc-saponite mineral but rather a type of defect structure. The defect structure arises from a deficiency in the total number of ions in octahedral coordination. This concept of stevensite as a defect structure seems to fit all of the data from X-ray, infrared, differential thermal analysis, and solution studies. ***George T. Faust, John C. Hathaway, and Georges Millot.*** *American Mineralogist*, v. 44, nos. 3-4, Mar.-Apr. 1959, p. 342-370.

9112* Increasing Water Yield in Southern California Mountains. The work at the San Dimas Experimental Forest. ***James H. Patric.*** *American Water Works Association, Journal*, v. 51, Apr. 1959, p. 474-480.

9113* Electro-Osmosis and Its Practical Application in Mining. (*In Hungarian.*) Az elektroozmózis és gyakorlati alkalmazása a bányászatban. ***Ferenc Vigh.*** *Bányászati Lapok*, v. 92, nos. 2-3, Feb.-Mar. 1959, p. 170-186.

9114* Some Physical Properties of Sea Ice. I. Study is based on work done in Shippegan, N.B., in 1956-57, with some data from an ice-breaker expedition in the summer of 1956. Tritium dating of sea ice is unsatisfactory. The jaggedness of ice crystals is suggested as a measure combining effects of age and thermal regime. Measurements of specific gravity, salinity, electrical resistivity, and permeability profiles all show progressive changes in annual sea ice throughout the winter. The tensile strength of sea ice at −20 C was from 200 to 500 p.si., at various angles to the grain. Shear strengths were 80 to 160 p.s.i. ***E. R. Pounder and E. M. Little.*** *Canadian Journal of Physics*, v. 37, Apr. 1959, p. 443-473.

9115* High Resolution of Anomalies From Airborne Two-Plane EM Method. ***Hans Lundberg.*** *Canadian Mining Journal*, v. 81, Apr. 1959, p. 101-106.

9116* Statistical Determination of the Chances of Success in Mineral Exploration in Canada. Attempts to derive by statistical studies the unwritten and unknown "success factor" or, more explicitly, "the chances of success in mineral exploration in Canada" and recommends that careful studies be made prior to the selection of any ground which is to be subjected to intensive exploration. ***T. Koulomzine and R. W. Dagenais.*** *Canadian Mining Journal*, v. 81, Apr. 1959, p. 107-110.

9117* Research-Potent Factor in Mineral Resources and Other Development. Points up importance of research to industry and to Canada as a whole and stresses the need for a greatly stepped-up effort in fundamental research. ***W. E. Van Steenburgh.*** *Canadian Mining Journal*, v. 81, Apr. 1959, p. 119-121.

9118 Shale Oil . . . How Soon? With world energy requirements expected to be six times as great by 2010, the complex engineering involved in extracting shale oil is a vital study for chemical engineers. ***Fred L. Hartley.*** *Chemical Engineering Progress*, v. 55, Mar. 1959, p. 59-64.

9119* Effect of the Purity of Water Upon the Generation of Electric Charges During Freezing. The potential difference between ice and water increases with the purity of water. (*In French.*) Influence de la pureté de l'eau sur la production de charges électriques accompagnant la congélation. ***Maud Roulleau.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* v. 248, no. 13, Apr. 1, 1959, p. 2024-2025.

9120* Advancements in Air Drilling During 1958. ***F. W. Smith.*** *Drilling Contractor*, v. 15, no. 3, Apr.-May 1959, p. 56-58.

9121* A High-Calcium Drilling Fluid. Reviews the laboratory and field results which have been obtained with a drilling fluid containing 3000 to 4000 ppm soluble calcium. ***P. H. Monaghan and J. L. Gidley.*** *Drilling Contractor*, v. 15, no. 3, Apr.-May 1959, p. 68 + 4 pages.

9122 Tracking Earth's Weather With Cloud-Cover Satellites. Earth satellite scans the earth and transmits television-type pictures to ground stations to track major storms. Video signal is generated by alternate optical cells as satellite orbits. Electronics package includes miniature tape recorder and necessary r-f circuits. ***R. Hanel, et al.*** *Electronics*, v. 32, no. 18, May 1, 1959, p. 44-49.

9123* The Interior of the Earth as Revealed by Earthquakes. The study of seismic waves resulting from earthquakes has long been a means of investigating the inner structure of the Earth. Recent improvements in recording instruments and in methods of analyzing results obtained by them have increased the knowledge in this field. ***I. Lehmann.*** *Endeavour*, v. 18, no. 70, Apr. 1959, p. 99-105.

9124* Drilling and Blasting at the Jackpile Mine. A résumé of some experiments to determine the most economical method of removing overburden at the world's largest open-pit uranium mine. ***H. H. Hearon.*** *Explosives Engineer*, v. 37, no. 2, Mar.-Apr. 1959, p. 39-45.

9125* On Principle Set-Up of Exploration and Prospecting Methods for Oil and Gas. Discussion of this problem illustrated by the analysis of the investigation history of the geology and petroleum and gas bearing of Terek-Kuma plain. (*In Russian.*) O printripial'noi skheme metodiki poiskov i pazvedni skoplenïĭ nefti i gaza. ***A. G. Alexin.*** *Geologiia Nefti i Gaza*, v. 3, no. 4, Apr. 1959, p. 24-31.

9126* Experimentations With Diamond Bits in Addition to Carbide-Tipped Bits and Roller Cutters in Gas Well Drilling at the General Blumenthal Mine. An eccentric carbide-tipped bit, a roller cutter and a solid diamond bit respectively 80, 95, and 66 mm. in diameter are studied in regard to their advantages and disadvantages from the point of view of their stability and life. In case of difficult drilling, the use of a solid diamond bit proved very effective. (*In German.*) Erfahrungen mit Diamantkronen neben Hartmetallschneiden und Rollenmeisseln beim Gasbohren auf der Zeche General Blumenthal. ***Henirich Wunsch.*** *Glückauf; Bergmännishe Zeitschrift*, v. 95, no. 5, Feb. 28, 1959, p. 265-273.

9127* Physical Investigations on the Growth of Snow Crystals. Investigates snow crystals developed in aerosol free air; mechanism of attachment of droplets to ice surface; the nature of ice surface and sublimation process, effect of impurity in air on the shape of snow crystals. ***Ukichiro Nakaya, Masando Hanajima, and Jiro Muguruma.*** *Hokkaidô University. Faculty of Science, Journal*, v. 5, Ser. II. Physics, no. 3, July 1958, p. 87-118 + 14 plates.

9128 First British-Built Drilling Platform. Mobile oil drilling platform designed in America, was built at Southampton. *Institute of Petroleum Review*, v. 13, Apr. 1959, p. 104.

9129* Some Remarks on the Interaction of Solar Plasma and the Geomagnetic Field. Currents flowing in ion clouds closer than one earth's radius from the surface of the earth will flow in plasma sheets moving along the curved magnetic lines of force as a condition of dynamic balance of centripetal forces. These currents produce perturbation fields of the size and direction required to explain storm-time geomagnetic variations. ***James W. Warwick.*** *Journal of Geophysical Research*, v. 64, no. 4, Apr. 1959, p. 389-396.

9130* A Hypothesis Concerning the Dynamic Balance of Fresh Water and Salt Water in a Coastal Aquifer. The dispersion of salts produced by reciprocative motion of the salt-water front in a coastal aquifer induces a flow of salt water from the floor of the sea into the zone of diffusion and back to the sea. The head losses that accompany the landward flow tend to lessen the extent to which the salt water occupies the

aquifer. ***H. H. Cooper, Jr.*** *Journal of Geophysical Research*, v. 64, no. 4, Apr. 1959, p. 461-467.

9131* The Role of Hysteresis in Reducing Evaporation From Soils in Contact With a Water Table. ***Richard A. Schleusener and A. T. Corey.*** *Journal of Geophysical Research*, v. 64, no. 4, Apr. 1959, p. 469-475.

9132* The Electric Charge on Condensate and Water Droplets. It was found that dew produced artificially on a thin wire was electrified negatively when the water temperature of the reservoir for supplying water vapor was lower than about 80 C and positively when the temperature was higher than about 85 C. The electrification phenomena of the condensate were considered to be originated from the electric charge on individual water droplets, because it was observed that the droplets were electrified when they rose from the water surface of the reservoir, and the sign of charge on the individual droplets agreed well with that of the condensate. ***Choji Magono and Tsutomu Takahashi.*** *Journal of Meteorology*, v. 16, no. 2, Apr. 1959, p. 167-172.

9133* On Ice-Crystal Production by Aerosol Particles. A general theory is developed and its predictions compared with experiment. It is found possible to decide under what conditions a given particle will act as a sublimation or as a freezing nucleus, and it is concluded that AgI generally behaves as a sublimation nucleus. ***N. H. Fletcher.*** *Journal of Meteorology*, v. 16, no. 2, Apr. 1959, p. 173-180.

9134* Effect of Ozone on the Total Sky and Global Radiation Received on a Horizontal Surface. Consideration of the ozone absorption placing the total ozone of the entire atmosphere on the top of the atmosphere brings the theoretical values of the sky radiation to a remarkable agreement with the values measured in the Antarctic under a very low atmospheric turbidity. ***J. V. Dave and Z. Sekera.*** *Journal of Meteorology*, v. 16, no. 2, Apr. 1959, p. 211-212.

9135* Activated Salt Surfaces in Ice Nucleation and Growth, and the Formation of Droplets. ***Henry M. Papée.*** *Journal of Meteorology*, v. 16, no. 2, Apr. 1959, p. 217-218.

9136* Cornubite, a New Mineral Dimorphous With Cornwallite. ***G. F. Caringbull, M. H. Hey, and R. J. Davis.*** *Mineralogical Magazine and Journal of the Mineralogical Society*, v. 32, Mar. 1959, p. 1-5.

9137* The Formation of a Diffusion Reaction Skarn by Pure Thermal Metamorphism. Veins and nodules of cornstone, enclosed in sandstone, have reacted to the thermal influence of a tertiary dolerite dyke by the development of a wollastonite reaction skarn, formed as a result of pseudomorphous replacement of the quartz grains by wollastonite, due to outward diffusion of calcium. ***W. Q. Kennedy.*** *Mineralogical Magazine and Journal of the Mineralogical Society*, v. 32, Mar. 1959, p. 26-31 + 2 plates.

9138* Some Further Heating Experiments on Natural Titaniferous Magnetites. Results of the heating of samples of magnetite containing exsolution bodies of ilmenite, or of ulvöspinel and ilmenite at 1250-1300 C under oxidizing, and under reducing conditions. ***J. B. Wright.*** *Mineralogical Magazine and Journal of the Mineralogical Society*, v. 32, Mar. 1959, p. 32-37 + 1 plate.

9139* A New Method for Thermal Dehydration Studies of Clay Minerals. The water vapor released upon heating the specimen is driven through a water absorber. The intensity of the exothermic reaction produced by absorption of the water is recorded against the temperature of the specimen. A series of curves obtained with various clay minerals are presented to illustrate the method. The significance of results in the identification of the clay minerals and the determination of their structure are considered. ***Georges Kulbicki and Ralph E. Grim.*** *Mineralogical Magazine and Journal of the Mineralogical Society*, v. 32, Mar. 1959, p. 53-62.

9140 Sand Deposits of Titanium Minerals. A world survey of geologic processes as illustrated by Indian deposits. ***J. L. Gillson.*** *Mining Engineering*, v. 11, Apr. 1959, p. 421-429.

9141* Airborne Radiometric Surveying. An assessment of its place in future exploration. ***A. Hatton.*** *Mining Magazine*, v. 100, no. 4, Apr. 1959, p. 209-210.

9142* Extensive Deep Sea Sub-Bottom Reflections Identified as White Ash. On *Vema* cruise 15 a sub-bottom echo was observed over a very large area of the eastern part of the tropical Pacific Ocean. Long piston cores at eight locations penetrated to the depth of this echo in the sediment, and in most cases well beyond. A layer of clean white ash was encountered in each of these cores at the appropriate depth. This report describes the cores on the basis of a preliminary shipboard examination. ***J. Lamar Worzel.*** *National Academy of Sciences, Proceedings*, v. 45, Mar. 1959, p. 349-355.

9143 Contamination by Extra-Terrestrial Exploration. General principles, contamination endangering physical and chemical studies, biological contamination. *Nature*, v. 183, Apr. 4, 1959, p. 925-928.

9144* Inheritance in Endogenous Ore Formation. (*In Russian.*) Nasledovanie pri endogennom rudoobrazovanii. ***V. I. Smirnov.*** *Nauchyne Doklady Vysshcĭ Shkoly, Geologo-Geograficheskie Nauki*, 1958, no. 4, p. 23-25.

9145* On a Characteristic of Underground Water Movement, Important for Geochemistry. The draining effect of valleys and other depressions propagates hypsometrically below them and results in a cycling water exchange. Thus dynamics of underground waters affects numerous geochemical processes in the upper layers of the earth's crust. (*In Russian.*) Ob odnoi zanonomernosti dvizheniia podzemnykh vod vazhnoĭ dlia geokhimii. ***A. I. Germanov.*** *Nauchnye Doklady Vysshcĭ Shkoly, Geologo-Geograficheskie Nauki*, 1958, no. 4, p. 26-32.

9146* The van Allen Radiation Belt and Its Possible Origins. One suggestion is that this intense radiation surrounding the Earth is a by-product of cosmic rays; another that it originates in the solar atmosphere. But the possibility that it derives from nuclear explosions cannot be ignored. ***Henry Elliot.*** *New Scientist*, v. 5, Apr. 9, 1959, p. 787-790.

9147 In Deep-Well Pumping, Know Your Well Loads. Small changes in well conditions can result in expensive damage to equipment. A survey of 22 deep wells reveals that Mills formula for polished-rod load is most accurate, counter-balance requirements are about 85% of polished-rod load, and formation-volume factor and plunger velocity are two aids to use. ***Marvin L. Thompson.*** *Oil and Gas Journal*, v. 57, no. 18, Apr. 27, 1959, p. 155 + 4 pages.

9148 What the Past Year Taught Us About Air Drilling. It was a time of great advancements. Of primary importance was the development of methods and materials to combat formation water that enters the hole while drilling. ***F. W. Smith.*** *Oil and Gas Journal*, v. 57, no. 18, Apr. 27, 1959, p. 169 + 2 pages.

9149* Use of the Method of the Carbon Coefficient in Forecasting Oil-Bearing Capability. The use of this method in general integrated oil exploration operations (in the first stages) may yield some benefit. ***V. S. Vyshemirskii.*** *Petroleum Geology*, v. 2, no. 6-B, 1958, p. 582-587.

9150* Question of Preparing Oil Reserves. Review of the problem with emphasis on the Tatar oil-bearing areas. ***S. N. Shangin, V. P. Onoprienko, and G. V. Kliarovskii.*** *Petroleum Geology*, v. 2, no. 6-B, 1958, p. 582-587.

9151* The Evolution of Endogenous Ore Formation. The paper indicates the general large-scale laws of the formation and distribution of endogenous deposits and follows their change in the course of geological history of the earth. (*In Russian.*) Evoliutsiia endogennogo rudoobrazovaniia. ***V. I. Smirnov.*** *Priroda*, v. 48, no. 4, Apr. 1959, p. 17-22.

9152* Observation of Rapid Pulsations of the Geomagnetic Field and Earth Currents. Observation stations of the USSR and equipment used by the Institute of the Physics of the Earth of AS, USSR. (*In Russian.*) Nabliudenie bystrykh pul'satsiĭ geomagnitnogo polia i zemnykh tokov. ***A. G. Kalashnikov.*** *Priroda*, v. 48, no. 4, Apr. 1959, p. 59-62.

9153* Formation of Spar Magnetite Deposits in the Eastern Alps. Deposits of spar in the Eastern Alps; possibility of their sedimentary formation; theories regarding the formation of magnesite spar in the Eastern Alps and the objections made by H. Leitmeier and W. Siegl against the metasomatosis and their refutation; magnesite of the Kaswassergraben and of the Stangensattel; re-dolomitization. (*In German.*) Zur Genesis der ostalpinen Spatmagnesit-Lagerstätten. ***O. M. Friedrich.*** *Radex Rundschau*, 1959, no. 1, Jan., p. 393-420.

9154* Study of the Mechanical Process of the Propagation of Detonation. It appears that mainly as a consequence of the destruction of the confinement by the mechanical action of the exciter cartridge the distances of self-excitation of explosives which propagate the detonation mainly by shock wave action are found to change appreciably when the nature of the confinement is changed. (*In French.*) Etude du mécanisme de la transmission de la détonation. ***M. Giltaire and J. Cocu.*** *Revue de l'Industrie Minérale*, v. 41, no. 3, Mar. 1959, p. 237-250.

9155 Rock Magnetism. The magnetization of ancient rocks bears on the questions of polar wandering and continental drift. ***S. K. Runcorn.*** *Science*, v. 129, Apr. 17, 1959, p. 1002-1012.

9156* On the Questions of the Geology and Oil-Gas-Bearing Ability of the Area of the Middle Course of Ob. In spite of an incomplete study of this territory, the present views on its geological pattern and direct showings of oil-gas-bearing ability of the sediments developed within its limits permit one to expect the existence of large deposits of oil and combustible gases. (*In Russian.*) Perspektivy neftenosnosti raĭonov srednego techeniia r. obi zapadno-sibirskoĭ nizmennosti. ***Iu. K. Mironov.*** *Sovetskaia Geologiia*, v. 2, no. 2, Feb. 1959, p. 7-15 + 1 insert.

9157* Classification of Liquid Inclusions in Minerals. Classification into primary and secondary inclusions, according to their formation and content. (*In Russian.*) Klassifikatsiia zhidkikh vkliucheniĭ v mineralakh. ***G. G. Laemmlein.*** *Vsesoiuznoe Mineralogicheskoe Obshchestvo, Zapiski*, v. 81, ser. 2, no. 2, 1959, p. 137-143.

9158* The Seeding of Cumulus Clouds by Ground-Based Silver Iodide Generators. Results of the 1957 Project Skyfire program experiments in the Bitterroot Mountains at the Montana-Idaho border. ***Vincent J. Schaefer and John H. Dieterich.*** *Zeitschrift für Angewandte Mathematik und Physik*, v. 10, no. 2, Mar. 25, 1959, p. 174-188.

9159* The Effect of Surface Active Substances on the Crystal Shape and Texture of Zinc Deposits. The mechanism of action of surface active substances is determined by the increase in work of formation of two-dimensional nuclei. (*In Russian.*) Vliianiie poverkhnostno- antivnykh veshchestv na formu vristallov i tensturu vsadkov tsinka. ***K. M. Gorbunova and K. P. Lebedeva.*** *Zhurnal Fizicheskoi Khimii*, v. 33, no. 3, Mar. 1959, p. 669-676 + 1 plate.

See also: **8697** (clay minerals); **8701** (coal mining); **8951** (hard-faced drill bits); **9214** (geological literature–1957); **9620** (Cd, a materials survey).

GRAPHIC ARTS

9160 Color Captures Research Realism. Technological improvements are currently turning color photography into a full-fledged research laboratory tool. Examples are cited. *Chemical Week*, v. 84, no. 19, May 9, 1959, p. 59 + 3 pages.

9161 *f*/2.9 Streak Camera. A streak camera with time resolution approaching that of the fastest modern types but with a considerably improved *f*/number. ***F. L. Brauer and D. F. Hansen.*** *Optical Society of America, Journal*, v. 49, May 1959, p. 421-424.

9162 Solving Printing Problems. Papers presented at the third conference of the Association of Printing Technologists dealing with the measurement of color of fluorescent papers, a color monitor for sheet fed machines, bleached esparto and spruce sulphite papers, and problems of bookbinding. ***J. M. Adams, et al.*** *Paint Manufacture*, v. 29, May 1959, p. 165-168.

9163* Significant Trends for Printing Production. Discusses future developments in the printing industry, all tending to foster more efficient production. It is going to be necessary for printing management to pay more attention to long-range planning within the industry. Many policy decisions regarding equipment, facilities, and methods will have to be made in the near future. The important thing is for management representatives to utilize the information that has been supplied today and to have their decisions influenced by the ideas and convictions that have been expressed during this program. ***J. Homer Winkler.*** *Share Your Knowledge Review*, v. 40, no. 7, Apr. 1959, p. 3-6.

9164* Photographic Processing Equipment. Conventional methods of photographic processing and the functional elements of processing machines such as drives, recirculation systems and agitation devices are reviewed, particularly as related to motion-picture film. ***John R. Turner.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, Apr. 1959, p. 211-221.

9165 The Reproduction of Colour. The book presents the subject without mathematics or technicalities, in the hopes that all those engaged in producing, selling, buying or using color pictures will be able to see the nature of the problems they encounter. In the last half of the book the discussion attempts to be quantitative rather than merely descriptive. ***R. W. G. Hunt.*** 208 pp. + 11 plates. 1957. Macmillan, New York. (TR510 H91r)

9166* Investigation of the Wetting in Manufacturing Photographic Films and Paper. Investigation of the wetting phenomena, methods for their characteristic and industrial wetting agents and their concentrations. (*In German.*) Untersuchungen über die Benetzung bei der Herstellung photographischer Filme und Papiere. ***Christian Brehmer and Rudolf Reuther.*** *Zeitschrift für Wissenschaftliche Photographie, Photophysik und Photochemie*, v. 53, nos. 4-6, Feb. 1959, p. 78-98.

See also: **8926** (printing on foil); **9222** (contour mapping densitometer).

HEAT POWER

9167 Details of the Ford Gas Turbine. Ford's new 300-hp gas turbine engine is said to attain maximum fuel economy in a range of 25 to 100% of power. *Automotive Industries*, v. 120, no. 9, May 1, 1959, p. 35.

9168 JT4 Designed for Growth as Transport Size Increases. Pratt & Whitney has planned 50% growth factor into basic turbojet design to meet expected enlargement of subsonic transports. ***J. S. Butz, Jr.*** *Aviation Week*, v. 70, May 4, 1959, p. 60 + 3 pages.

9169* New Types of Galvanic Fuel Cells. Direct production of electrical energy from fuel and the advantages in so doing. ***J. F. Straatman.*** *British Chemical Engineering*, v. 4, May 1959, p. 286-288.

9170 Investigation of the Ignition of a Gas by an Electric Spark. By using flashes of microsecond duration it has been possible to obtain a series of shadowgrams showing the development of steadily propagating methane-air flames. About 100 μs must elapse before any difference can be detected between the flame kernels which will propagate and those which subsequently degenerate. ***D. R. Lintin and E. R. Wooding.*** *British Journal of Applied Physics*, v. 10, Apr. 1959, p. 159-166.

9171* Design and Applications of Mach 4 Turbine Engines. ***M. A. Zipkin and R. E. Neitzel.*** *Canadian Aeronautical Journal*, v. 5, no. 4, Apr. 1959, p. 130-137.

9172* Graphite as a Material of Construction for Heat Exchangers. Discusses the special considerations involved in using graphite as a material of construction, and takes, as

an example, a heat exchanger formed from solid blocks of graphite. Concludes that the same basic approach can be applied to other materials and to other types of equipment. ***A. Hilliard.*** *Chemical & Process Engineering*, v. 40, Apr. 1959, p. 127-129.

9173* A New Range of Diesel Engines. Advances in the AT diesels of Ruston and Hornsby Ltd. *Coke and Gas*, v. 21, Apr. 1959, p. 156-157.

9174* Diesels for Taxicabs. A new gasoline-powered Plymouth Savoy 4-door sedan taxicab has been converted and powered by a Perkins P4C 4-cylinder diesel engine. ***Jim Brown.*** *Diesel and Gas Turbine Progress*, v. 25, May 1959, p. 22-23.

9175* 100 Foot Tug of Improved Design. Specifications of the general-purpose 100-ft. tug designed by the Marine Design Department of the Cleveland Diesel Engine Division of General Motors. *Diesel and Gas Turbine Progress*, v. 25, May 1959, p. 26-27.

9176* Tennessee Gas Pipeline's Biggest Compressor Station. Station 106 is one of the world's largest pipeline compressor stations. It has 38,400 HP, and on peak days it can handle better than 1.7 billion cu. ft. of gas. ***Donald M. Taylor.*** *Diesel and Gas Turbine Progress*, v. 25, May 1959, p. 43-45.

9177* TVA Builds 500-Mw Steam Unit, Largest Yet Ordered in U. S. A. Widows Creek No. 7, scheduled for late 1960 completion, to bring plant capability to 1250 Mw, 4.5% of system total. ***R. M. Gardner.*** *Electrical World*, v. 151, May 18, 1959, p. 70 + 3 pages.

9178* 2300 H.P. Diesel-Electric Locomotives. Describes the most powerful diesel-electric locomotive yet erected in British Railways workshops. *Engineer*, v. 207, May 1, 1959, p. 696-698.

9179* A New Product Design: Evolution of a 6,000-kw Generating Plant for Peaking and Reserve Capacity. ***B. B. Brownell.*** *General Motors Engineering Journal*, v. 6, no. 2, Apr.-May-June, 1959, p. 28-35.

9180 High Temperature Galvanic Fuel Cells. Thermodynamic and kinetic considerations, polarization, current-voltage characteristics, some practical aspects, apparatus and techniques, investigation of electrolytes according to Davtyan, experimental development of the laboratory fuel cell, experimental methods and results. ***Gerard Herman Jelke Broers.*** 314 pp. 1958. (TK1041 B78h)

9181* The Operation Mechanism of a Diffusion Electrode (Applicable to Hydrogen-Oxygen Fuel Elements). On the basis of A. V. Lykov's theory of transfer of substance in bodies with capillary pores, the paper proposes a mechanism for operating a gas diffusion electrode by which electrodes for gas fuel elements can be rationally constructed. (*In Russian.*) O mekhanizme raboty gazovogo diffuzionnogo elektroda (primenitel'no k vodorodno-kislorodnomu toplivnomu elementu). ***I. G. Gurevich.*** *Inzhenerno-Fizicheskŭ Zhurnal*, v. 2, no. 4, Apr. 1959, p. 78-86.

9182* The S.N.E.C.M.A. Test Plant at Melun-Villaroche for Ramjet Engines. After reference to the installations at the disposal of the S.N.E.C.M.A. for carrying out tests with ramjet engines, the principle of an open jet plant is explained. Describes a plant of this kind; details of the test possibilities afforded; and particulars of ramjet engines in the course of development or on test beds. (*In German.*) Versuchsanlage für Staustrahltriebwerke der S.N.E.C.M.A. in Melun-Villaroche. ***R. Féraud, M. J. Jannot, and R. Alder.*** *Luftfahrttechnik*, v. 5, Apr. 1959, p. 102-105.

9183* Some Considerations Affecting the Design of Engines for Short-to-Medium Range Airliners. Details of test results concerning optimum conditions for the bypass principle used in the Rolls-Royce "Conway" bypass turbine. Comments on the importance of the jet mixing process in the bypass engine and detailed considerations concerning the most suitable type of engine for short range duties. (*In German.*) Einige Betrachtungen über den Entwurf von Triebwerken für Kurzbis Mittelstrecken-Verkehrsflugzeuge. ***H. Pearson and R. M. Fitzgerald.*** *Luftfahrttechnik*, v. 5, Apr. 1959, p. 106-113.

9184* Ultrasonic Axial Flow Compressors. Shows that, with axial flow compressors higher stage-pressure ratios and axial rates of travel can be achieved if the compressor rotor is designed as an ultrasonic diffuser with diverging blade channels, whereby the stator serves to deflect an ultrasonic flow. (*In German.*) Überschall-Axialverdichter. ***H. Bischoff.*** *Luftfahrttechnik*, v. 5, Apr. 1959, p. 114-116.

9185* Soundproofing Research and Development Plants for Jet Engines. General views are expressed on the investigation of the correlation between jet engine test plants and silencing arrangements and directives for soundproofing have been drawn up. It is held that the velocity of gas in long silencers should not exceed 15 m.p.s. For flat silencing elements exhibiting no variations in their cross-sectional area, no reductions in particular, are advocated. (*In German.*) Schalldämpfung von Forschungs- und Entwicklungsanlagen für Strahltriebwerke. ***H. Dahlen and W. Lohse.*** *Luftfahrttechnik*, v. 5, Apr. 1959, p. 117-123.

9186* Diesel Engines of New Design. Units covering a power range from 233 h.p. to 466 h.p. at 2100 r.p.m. consisting of an in-line six-cylinder engine, an eight-cylinder vee-form engine and a 12-cylinder vee-form engine. *Machinery Lloyd (Overseas Ed.)*, v. 31, no. 9, Apr. 25, 1959, p. 69-70.

9187* Thermal Performance of the Philo Supercritical Unit. Reviews two years operation of the Philo 6 development unit of the Ohio Power Company. Two 450,000-kw units are now being built on Philo 6 experience. ***A. S. Grimes and J. A. Tillinghast.*** *Mechanical Engineering*, v. 81, Apr. 1959, p. 81-84.

9188 ARCON and ARCAS Renew Interest in End-Burning Rockets. Descendants of earlier JATO's offer high-burning rates and flexibility and may provide cheap rockets for weathermen. ***Michael Lorenzo.*** *Missiles and Rockets*, v. 5, no. 19, May 11, 1959, p. 20-21.

9189 Fluorine Engines May Arrive Within Five Years. Dramatic increase in rocket capability will come when compatible materials are developed. Fuel supply considered more than adequate. ***Paul Means.*** *Missiles and Rockets*, v. 5, no. 19, May 11, 1959, p. 42-43.

9190* Energy for Space Vehicles. To meet the high energy requirements needed for propulsion and communication in space, solar radiation, ion emission, new chemicals, and nuclear fission are being studied as likely sources. ***Roy W. Johnson.*** *Ordnance*, v. 43, May-June 1959, p. 916-918.

9191* Rocket Readiness. The methods for the improvement of reliability in solid rocket motors must be far different from those where essential data can be obtained from multiple tests of a small number of samples. ***J. W. Wiggins.*** *Ordnance*, v. 43, May-June 1959, p. 1010-1012.

9192 Gas Turbine Applications in Gasoline Plants. Space, time and money-saving methods for utilizing various characteristics of the increasingly popular gas turbine. ***C. R. Apitz.*** *Petroleum Engineer*, v. 31, May 1959, p. C20 + 5 pages.

9193 Three-Level Masers as Heat Engines. Attempts to show that three-level masers can be regarded as heat engines. ***H. E. D. Scovil and E. O. Schulz-DuBois.*** *Physical Review Letters*, v. 2, no. 6, Mar. 15, 1959, p. 262-263.

9194* Determine Film Coefficients Quickly. To check performance when getting bids on new heat exchangers you have to calculate the units' thermal resistance. Simplify this job by using these charts. ***R. S. Thurston.*** *Power*, v. 103, May 1959, p. 66-67.

9195* The Future for Solid Propellant Rockets. Shows how the performance of these rockets has improved during the past decade and also how they can provide controlled thrust to meet any missile requirement. ***K. W. Pearce.*** *Royal Aeronautical Society, Journal*, v. 63, Apr. 1959, p. 221-226.

9196* The Utilisation Factor of the Exhaust Energy in Turbocharged Two-Stroke Engines. Stresses the importance of allowing for piping losses in the exhaust systems of turbocharged two-stroke Diesel engines. The utilization factor by

which these losses are characterized is then defined and the typical differences in the calculation of these losses in pulse and constant-pressure operation are described. ***A. Steiger.*** *Sulzer Technical Review*, v. 40, no. 2, 1958, p. 47-65.

9197 Engine Operating Conditions That Cause Thermal-Fatigue Cracks in Turbojet-Engine Buckets. Five engine tests were conducted to definitely establish the failure mechanism of leading-edge cracking and to determine which conditions of engine operation cause the failures. Five groups of S-816 and M-252 buckets from master lots were run consecutively in the same J47-25 engine. Results show that the primary cause of leading-edge cracking is thermal fatigue produced by repeated engine starts. Demonstrates that leading-edge cracking can be prevented simply by starting the engine gradually. ***James R. Johnson, John W. Weeton, and Robert A. Signorelli.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 4-7-59E, Apr. 1959, 24 pp. (TL782 Un3rm Vis.)

9198 Choosing Electrical . . . or Steam-Turbine Drives for the Process Industry. Only an individual analysis can determine which drive is best suited for a given plant. ***H. H. Fuehrer.*** *Westinghouse Engineer*, v. 19, no. 3, May 1959, p. 90-93.

See also: **8614** (German aircraft jet engine); **8975** (electrical propulsion systems for space vehicles).

INFORMATION—PREPARATION AND DISSEMINATION

9199 The Role of the Editor in Interdisciplinary Research. The rather special job of the editor in this situation is one of coordination of ideas, materials, and communicative techniques. In interdisciplinary research the editor finds his humanistic training invaluable. He should and does learn much about many scientific matters while he is on the job, but he learns about them as they relate to each other; thus, he does not have the chance to develop a professional bias for any one specialty. Though he should have a deep curiosity about things scientific, and should exercise it, his deepest interest should be in the humanities, preferably, of course, as they relate to communication and the English language. ***Andrew Bluemle.*** *American Documentation*, v. 10, no. 2, Apr. 1959, p. 105-107.

9200 Libraries and Information Services Behind the Iron Curtain. The author, formerly head of a Hungarian technical library, describes the activities of a technical library and the documentation and abstracting services performed in Hungary. ***Judith Szebenyi-Sigmond.*** *American Documentation*, v. 10, no. 2, Apr. 1959, p. 108-115.

9201 Technical Data on Border-Punched Cards. Describes the advantages of using border-punched cards for a catalog of ordnance fuzes. Hand-sorted punched cards were chosen for the catalog because they are versatile, easy to use, and permit unlimited expansion. Furthermore, they have a built-in cross reference system, and are second in speed only to machine-sorted cards, yet require no special equipment. ***Gunther Cohn.*** *American Documentation*, v. 10, no. 2, Apr. 1959, p. 116-121.

9202 Adaptation of Coordinate Indexing System to a General Literature and Patent File: Machine Posting. The patent and literature search group of Armour and Company, which furnishes information for patent attorneys as well as to research people, decided to use the Uniterm system of coordinate indexing after it became evident that conventional indexing procedures were inadequate. ***Shirley Jane Weinstein and Raymond J. Drozda.*** *American Documentation*, v. 10, no. 2, Apr. 1959, p. 122-129.

9203 On the Automatic Manipulation of Representations of Chemical Structures. The general system visualized here has, in addition to its potential practical implications, a unifying effect. One may see, with such a system as an ideal, the stop-gap and short-term nature of many existing systems. Perhaps it would be well for those devising future systems to see how their work fits into this larger pattern outlined. The accomplishment of such a universal system for manipulation of chemical representations is indeed a challenging task for the years ahead. ***Ascher Opler.*** *American Documentation*, v. 10, no. 2, Apr. 1959, p. 130-134.

9204* Clarity: An Essential in the Engineer's Report. ***W. P. Albrecht and Harold Orel.*** *American Engineer*, v. 29, Apr. 1959, p. 17-20.

9205* The Translation of Texts Dealing With Applied Science. Theoretically the scientific translator should have an "exhaustive" knowledge of the relevant languages, adequate understanding of the subject-matter, and familiarity with the current terminology. The average engineer's training, and approach and command of language will not as a rule make him a good translator. Since the translator must sift intention from often very involved and inexact phrasing, and render it appropriately in the target language, results will be satisfactory only within the limited range of subjects thoroughly studied by him, unless, perhaps, his work is revised and edited by experts. ***I. J. Citroen.*** *Babel*, v. 5, no. 1, Mar. 1959, p. 30-33.

9206 The "Information" Problem. Information operators in big cities must have at their fingertips literally tons of records containing up-to-date directory listings. In seeking a way to overcome this problem of bulk, systems engineers at Bell Laboratories are currently testing a radically new and extremely compact method of storing and retrieving directory information and are experimenting with several microphotograph techniques. ***I. C. Osten-Sacken.*** *Bell Laboratories Record*, v. 37, May 1959, p. 162-168.

9207* Bibliography of Material Related to Plastic Tooling. Bibliography and abstracts on plastic tooling literature. ***Orville D. Lascoe.*** v. I. 46 pp. 1957; v. II. 60 pp. 1958. American Society of Tool Engineers, Detroit. (ZTJ1185 L33p Ref.)

9208 Classification and Indexing in Science. This book explores modern techniques of subject analysis. It discusses in detail methods of constructing classification schedules for indexing. It describes the application of a notation to the schedules for card indexing, and illustrates their use. There is also a chapter on the application of classification in machine literature searching; discussing American work in this field. ***B. C. Vickery.*** 185 pp. 1958. Butterworths Scientific Publications, London. (Z696 V66c)

9209* Premature Disclosure of Technical Developments. Early disclosure of technical developments is often desirable; but if it is premature, it may result in loss of patent rights and may result in earlier inventions and patents by others. ***Paul J. Ethington.*** *General Motors Engineering Journal*, v. 6, no. 2, Apr.-May-June 1959, p. 36-37.

9210* Developments in Copying Methods—1958. ***Hubbard W. Ballou.*** *Library Resources and Technical Services*, v. 3, no. 2, Spring, 1959, p. 86-97.

9211* Mathematics Dictionary. The *Mathematics Dictionary* (1949) contained an exhaustive coverage of terms in the range beginning with arithmetic and extending through the calculus. This book has now been largely revised and many corrections made. Many additional terms have been added as well as miscellaneous terms chosen to increase the value of the dictionary. Additions include the basic terms in the fields of modern algebra, number theory, topology, vector spaces, the theory of games and linear and dynamic programming, numerical analysis, and computing machines. ***Glenn James and Robert C. James, editors.*** 546 pp. 1959. D. Van Nostrand Company, Princeton, N. J. (QA5 J23ma2)

9212* Research Planning and Documentation. (*In German.*) Forschungsplanung und Dokumentation. ***Paul Luchtenberg.*** *Nachrichten für Dokumentation*, v. 10, no. 1, Mar. 1959, p. 2-9.

9213* The Technique of Information Inside a Plant. The auxiliary means of the information technique inside a plant are analyzed and the information systems described with the help of graphic representations. Science, research and development are in need of this technique. Manufacturing engineers are more interested in the practical technique. (*In German.*) Innerbetriebliche Informationstechnik. ***Otto von Klewitz.*** *Nachrichten für Dokumentation*, v. 10, no. 1, Mar. 1959, p. 28-34.

9214* The Geological Literature in the Year 1957, Printed in the Publications of the Institutes of the Ministry of Higher Education of the USSR. Bibliography of articles by collaborators of the faculty of Geology of the Moscow State University on general geology, dynamic geology, and geomorphology. (*In Russian.*) Literatura po geologii za 1957, napechatannaia v izdaniiakh uchrezhdenii ministerstva vysshego obrazovaniia SSSR. *Nauchnye Doklady Vysshei Shkoly, Geologo-Geograficheskie Nauki,* 1958, no. 4, p. 218-237.

9215 Proceedings of the Eighth International Congress of Linguists. Abridged versions of the proceedings. ***Eva Sivertsen, editor.*** 885 pp. 1958. Oslo University Press, Oslo, Norway. (P3 In8p)

9216* Information Retrieval on Automatic Data Processing Equipment. This article begins a four-part series. ***B. R. Faden.*** *Special Libraries,* v. 50, no. 4, Apr. 1959, p. 162-165.

9217 Hydroclones and Liquid Centrifuges. A list of 47 references. ***James M. Jacobs.*** *U. S. Atomic Energy Commission, TID*-3527, Mar. 1959, 6 pp. (UF767 Un3ti Contin.)

See also: **9104** (oil-shale and shale-oil patents); **9300** (bibliography of metallurgy of Ni and Co).

INSTRUMENTATION

9218* Synthetic Sapphire as Sensing Element in Infra-Red Detectors. As a heat sink, sapphire provides high electrical resistance and high thermal conductivity—both important qualities for fast, sensitive response. *Instrument Practice,* v. 13, Apr. 1959, p. 410.

9219 The Agreement Between Independent Methods for Particle Size Distribution Measurements on Finely Divided Powders Including Phosphates. The particle size distributions of various powdered substances as measured by a microscopic electronic sizing and counting technique and by an automatized liquid sedimentation balance are shown to exhibit log normal distribution behavior. The results of these two independent methods are shown to agree with the predicted values based on the transformations involving log normal distribution behavior. ***D. P. Ames, R. R. Irani, and C. F. Callis.*** *Journal of Physical Chemistry,* v. 63, Apr. 1959, p. 531-534.

9220 Linear Voltage Temperature Furnace for Thermal Analysis. A furnace is described which may be operated in a vacuum or an inert atmsophere, and which was developed for thermal analysis studies of beryllium and its alloys. Extremely rapid heating and cooling rates may be employed if required, or, with slow heating and cooling rates, a linear variation in voltage with time will produce a correspondingly near-linear variation in temperature. ***A. J. Martin and K. L. Edwards.*** *Journal of Scientific Instruments,* v. 36, Apr. 1959, p. 170-172.

9221 Analogue Computer for the Solution of Product Integrals. Describes the circuit, principles of operation and performance of the product-integral computer capable of accepting up to three input variables simultaneously; they are presented in the form of recorder chart traces which are traversed mechanically, but are followed by hand. The instantaneous product of the input variables, or of some preselected function of them, is formed and charted. ***F. D. Penny and J. W. McHugo.*** *Journal of Scientific Instruments,* v. 36, Apr. 1959, p. 173-179.

9222 Contour Mapping Microdensitometer. The instrument described in the present paper is basically a scanning microdensitometer in which a gating circuit is utilized in conjunction with an optical printing system to plot automatically a contoured density map of the photograph which is being scanned. The gating circuit used is comparatively simple and extremely stable and permits the insertion of as many contours as are required, at specified values of density. ***P. Hariharan and M. S. Bhalla.*** *Journal of Scientific Instruments,* v. 36, Apr. 1959, p. 192-195.

9223* Chemical Analysis by Push-Button Instrumentation. Use of the Norelco Autrometer, an automatic X-ray spectrograph. ***John S. Buhler.*** *Norelco Reporter,* v. 6, no. 1, Jan.-Feb. 1959, p. 3-13.

9224* A Universal Detector for the X-Ray Spectrograph. The objective, to make available a completely automatic X-ray spectrograph which would utilize the optimum detector and reflecting crystal for all wavelengths used in X-ray spectroscopy, required that the following conditions be fulfilled; first, a universal detector capable of efficient operation for all wavelengths in the range of .2 to 12.0Å, and secondly, a means of utilizing the optimum crystals in the above range. The successful development of a universal detector and automatic crystal changer allows complete automatic operation of the Autrometer. ***William R. Kiley.*** *Norelco Reporter,* v. 6, no. 1, Jan.-Feb. 1959, p. 23-25.

9225 Random Number Generator Using Subharmonic Oscillators. A random number generator which uses two 2000-Mc subharmonic oscillators is described. This generator can produce random binary digits at a maximum rate of approximately 3×10^7 digits per second. Statistical tests performed on over a quarter-million digits produced by this generator indicate that they were at least as random as digits produced by other slower contemporary means. ***Fred Sterzer.*** *Review of Scientific Instruments,* v. 30, Apr. 1959, p. 241-243.

9226 Recording Optical Pyrometer. A recording pyrometer which measures the brightness temperature at 0.65μ of a small incandescent sample in the range 1300 C to above 3000 C with a time constant of a few milliseconds is described. The instrument is reliable to within $\pm$ 20 C, and is suitable for measuring transient high-temperature fluctuations or for applications where use of a standard optical pyrometer might be hazardous to personnel. ***Norman A. Blum.*** *Review of Scientific Instruments,* v. 30, Apr. 1959, p. 251-253.

9227 Ten-Mc Pulse-Amplitude Discriminator. A pulse-height discriminator has been developed which is capable of operating at repetition rates up to 10 Mc. It accepts positive input pulses with a threshold adjustable from 1 to 11 v. The output signal is of constant shape and amplitude. The circuit is described and test results are given. ***Jacques Mey.*** *Review of Scientific Instruments,* v. 30, Apr. 1959, p. 282-284.

9228 High-Temperature Laboratory Vacuum Furnace. Describes a small resistance-heated vacuum furnace of simple design which has proved very satisfactory for the vacuum degassing of small ultra-high vacuum system components. The furnace has a working volume approximately 2.5 x 2.5 x 4.5 in. It can achieve a temperature of 1600 C with the expenditure of 2.0 kw of heating power. The pressure during firing is normally 2 to 3 x 10^{-5} mm. Hg. ***E. V. Kornelsen and J. O. Weeks.*** *Review of Scientific Instruments,* v. 30, Apr. 1959, p. 290-291.

9229* Recent Advances in Infra-Red Instrumentation. Development of low-cost, easy-to-operate, double-beam spectrophotometers. Application of scale expansion methods to trace analysis. Development of infra-red microspectroscopy and sampling techniques. ***S. F. D. Orr.*** *Spectrochimica Acta,* v. 14, Jan. 1959, p. 86-96.

9230* The Tape Machine. I. A New Tool for Spectrochemical Analysis. II. Applications Using Different Kinds of Isoformations. III. Notes on Useful Corrections in Spectrochemical Analysis With the Tape Technique. I. ***A. Danielsson, F. Lundgren, and G. Sundkvist.*** II.-III. ***A. Danielsson and G. Sundkvist.*** *Spectrochimica Acta,* 1959, no. 2, Apr., p. 122-137 + 2 plates.

9231* The Plasma Jet as a Spectroscopic Source. Plasma jet utilizes electromagnetic and thermal pinch effects to form an arc plasma into a flame-like cone of high energy. ***M. Margoshes and B. F. Scribner.*** *Spectrochimica Acta,* 1959, no. 2, Apr., p. 138-145.

9232 Symposium on Elevated Temperature Strain Gages. Subjects of the symposium: calibration techniques and instruments, gage alloys, foil gages, weldable gages, bonding agents, temperature compensation. It is to be noted that no investigator has reported upon a device to replace the resistance gage, al-

though the shortcomings of the latter at elevated temperatures are well documented herein. 163 pp. 1958. American Society for Testing Materials, Philadelphia. (TJ1166 Sy68)

See also: **9366** (high-temperature furnaces).

LUBRICATION AND FRICTION

9233* Bearing and Seal Development. Some current research by an aircraft-accessory manufacturer on bearings for operation up to 140,000 rpm and 1000 F, and on the unusual lubricants and seals needed. ***Stanley Gray.*** *Mechanical Engineering*, v. 81, Apr. 1959, p. 76-80.

9234* Ball Bearing With Near-Zero Torque Upgrades Gyro Performance. The "Dynamic" bearing is a self-contained, electromagnetically powered ball-bearing assembly that closely approaches the minimum friction achieved by knife edges, jeweled pivots or flotation devices, yet provides rugged support for relatively heavy gyro suspensions. *Military Systems Design*, v. 3, no. 2, Mar.-Apr. 1959, p. 68.

9235* Austenitizing Behaviour and Rapid Life Test of Drawn Wires for Bearing Balls. The austenitizing behavior and rapid life test property of five kinds of wire, used for balls, rollers, and needles of bearing, were investigated. The effect of ingot size on the lifetime was not appreciated, but the effect of different raw materials on it was apparent. The lifetime became better but crack damage worse on account of the V addition. ***Manabu Ueno.*** *National Research Institute for Metals, Transactions*, v. 1, no. 1, 1959, p. 22-26.

9236 Alloyed Plastics Give Oilless Bearings. ***H. Clay Mellor.*** *Product Engineering*, v. 30, no. 21, May 25, 1959, p. 58-60.

9237 Analysis of Bearing Material for Elevated-Temperature Application. Promising areas of investigation are specified for the development of bearing materials which will operate in air at elevated temperatures. A discussion of physical and chemical properties of bearing materials and of basic principles to be considered in this development is followed by recommendations. ***J. P. Denny.*** U. S. *Atomic Energy Commission, APEX*-464, Aug. 1957, 38 pp. (UF767 Un3.1ap Contin.)

See also: **8783** (oxygen in lubricating oil).

MECHANICAL ENGINEERING

9238 Discontinuity Stresses in Stiffened Cylindrical Shells. An approach is proposed enabling the discontinuity stresses to be determined for pressurized and heated cylindrical shells stiffened by plane bulkheads. Modifications to the analysis are suggested to allow for other forms of stiffening, and nonuniform shell temperatures. One obvious application for this analysis is the fuselage structure of a ballistic missile, which may consist of integral fuel and oxidant tanks in adjacent bays which are maintained at different internal pressures and temperature levels. ***D. J. Johns.*** *Aircraft Engineering*, v. 31, May 1959, p. 131-132.

9239 An Introduction to Advanced Dynamics. Newtonian principles; Hamilton's and Lagrange's equations; central force, rigid body, and oscillatory motions. ***S. W. McCuskey.*** 263 pp. 1959. Addison-Wesley Publishing Company, Reading, Mass. (QA845 M13i)

9240 Longer Life for Centrifugal Pumps. Cause and cure of cavitation and corrosion. ***Neal B. Heaps.*** *Chemical Engineering*, v. 66, May 4, 1959, p. 156 + 2 pages.

9241 Conduction of Heat in Solids. ***H. S. Carslaw and J. C. Jaeger.*** 2nd Ed. 510 pp. 1959. Oxford University Press, London. (QC321 C23c2)

9242* Engineering, Marine, Welding and Nuclear Energy Exhibition. Describes an exhibition held in April, 1959, at Olympia, London, showing products of some 500 British firms. *Engineer*, v. 207, Apr. 10, 1959, p. 560-567.

9243 Heat Transfer Engineering. Basic conduction theory, free convection, and forced convection, including heat transfer in compact surfaces, and to and from liquid metals. Radiation between two or more bodies; unsteady-state conduction in one, two, and three dimensional systems. Analysis of systems involving conduction, convection, and radiation, including the finned or extended surface, the simple boiler and condenser, and the heat exchanger in its various forms. ***Hilbert Schenck, Jr.*** 310 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, N. J. (QC320 Sch27n)

9244* The Design of Electromagnetic Pumps for Liquid Metals. Scope of d.c. pumps in meeting different duties and practical conditions. Results of an experimental investigation of d.c. pump performance in a 4 in.-diameter pipe loop. Significance of end current loss; equivalent reduction effected by the presence of a graded fringing field in the end regions. A technique of electrode "wetting" suitable for mercury and stainless steel; gas entrainment experiments. ***D. A. Watt.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. A, no. 26, Apr. 1959, p. 94-103.

9245* On the Determination of Stresses and Displacements for Unsymmetrical Deformation of Shallow Spherical Shells. The present report is concerned with problems of bending of thin, elastic, shallow spherical shells of uniform thickness. ***Eric Reissner.*** *Journal of Mathematics and Physics*, v. 38, no. 1, Apr. 1959, p. 16-35.

9246 Maximum-Work Bimetals. Whether the element must pick up a weight, compress a spring, operate a member against friction, or otherwise develop a force and move it through some distance, mechanical work is involved and influences design of the element. ***C. F. Alban and C. C. Perry.*** *Machine Design*, v. 31, Apr. 16, 1959, p. 143-148.

9247 Mechanics. I. Statics. II. Dynamics. Emphasizes practical and interesting problems. Chapters on vector methods have been added so that the notation of vector algebra and vector calculus may be employed. ***J. L. Meriam.*** 2nd Ed. 393 pp. and 420 pp. 1959. John Wiley & Sons, New York. (QA805 M54m2)

9248* Design and Welding of Alloy Cast Steel. The design, welding and quality control aspects of high quality castings are discussed relative to greater participation by foundries in these important phases of manufacture. Ways of protecting the present market, and regaining lost business through a better understanding of the customers' needs, are pointed out. ***L. W. Songer.*** *Modern Castings*, v. 35, May 1959, p. 79-87.

9249 Plastic Analysis of Structures. Presents the techniques necessary in the analysis of structures beyond the elastic limit and emphasizes the conditions under which a plastic analysis is appropriate. Structures treated include beams and frames in bending, beams under combined stresses, plates, shells, and slabs with cutouts. Primary attention is given to the determination of stresses under static loads; but displacements, variable loadings, minimum weight design, and dynamic loadings are also treated. ***Philip G. Hodge, Jr.*** 364 pp. 1959. McGraw-Hill, New York. (TG260 H66p)

9250 Cost Crisis—How to Beat It. How to Pick the Right Material. The "right" material may be the cheapest. The product design stage is probably the most important point at which to control material costs. A design specification requiring unnecessary or costly material can result in a waste of thousands of dollars over the life of the design. A product design committed to one material does not have to remain bound to that material. Periodic review can be rewarding. With rising costs so much of a problem (the costs of materials used by metalworking have leaped nearly 70% in the last ten years), proper material selection can be a big step toward eliminating the cost crisis. *Steel*, v. 144, Apr. 20, 1959, p. 84-87.

9251 Torsion Theory. (*In German.*) Torsionstheorie. ***Constantin Weber and Wilhelm Günther.*** 306 pp. + 1 Table. 1958. Friedrich Vieweg & Sohn, Braunschweig, Germany. (QA935 W38t)

9252 The Compressive Creep Buckling of Metal Columns. VI. Effect of Initial Imperfection. Columns with initial imperfections ranging from $\frac{L}{1000}$ to $\frac{L}{70}$ (where L is the column length) were tested at temperatures of 750, 850, and 900 F. Initial imperfection was found to influence very strongly the creep-buckling behavior of a column. In general, a significant inter-relationship was found to exist between column load, lifetime, temperature, and imperfection; i.e., the effects of any one factor are dependent upon the magnitudes of the other factors. The time-dependent secant- and tangent-modulus methods for estimating column capacity were investigated. It is shown that both estimates can be either conservative or nonconservative, depending upon the temperature and initial imperfection of the column. ***Alfred Rudnick, Robert L. Carlson, and George K. Manning.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 52-251, Oct. 1958, 52 pp. (TL507 Un3.18w Vis.)

9253 Considerations on the Incorporaton of Steel Castings in Welded Structures. Increased attention to cast-weld and composite weldments in engineering design provides a vast field of opportunities and applications in large structures. The availability of higher-quality steel castings, through simplification of casting design and their inclusion in welded products is significant of industrial growth for both the foundry and welding industries. ***Samuel W. Gearhart, Jr.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 295-306. (T21 Un3r Contin.)

9254* The "Hydraflo" Pump. A high pressure reciprocating pump of entirely new design in which the power transfer is achieved by hydraulic oil flow instead of the conventional gears, crankshafts and connecting rods. *Water and Water Engineering*, v. 63, Apr. 1959, p. 159-162.

See also: **8595** (hydraulic missile-components); **8701** (properties of brittle materials); **9232** (strain gages); **9335** (design of castings); **9358** (designing for Al die castings); **9359** (designing for Zn die castings); **9360** (designing for investment casting); **9361** (designing for permanent mold casting); **9362** (designing for plaster mold casting); **9433** (designing for steel extrusions); **9686** ("Delrin" in engineering design); **9783** (design of castings and weldments); **9785** (design of welds for vibration control).

METALLURGY

9255* Heat Treatment, Transformation Reactions, and Mechanical Properties of Some High-Strength Zirconium-Base Alloys. The mechanism of hardening in heat-treatable Zr alloys was found to be analogous to that for Ti alloys. Application of these findings in Zr-Mo-Sn and Zr-Nb-Sn alloys produced strengths as high as 190,000 psi with reasonable ductility. ***H. A. Robinson, J. R. Doig, M. W. Mote, and P. D. Frost.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 237-245.

9256* Low-Carbon Mn-Cr-Mo-V Steel for Pressure Vessels. As the size of welded pressure vessels increases, the use of mild-steel plates becomes less satisfactory and material of higher strength becomes essential. The only satisfactory solution is to introduce alloying elements while maintaining the C content at a relatively low level. The Mn-Cr-Mo-V steel described in this article was developed in the light of production experience to provide the desired combination of properties at the minimum cost. ***I. M. Mackenzie.*** *Chemical & Process Engineering*, v. 40, Apr. 1959, p. 132-136.

9257* High-Nickel Alloys in the Petroleum Industry. II. Part I of this article, published in the March issue, dealt with the applications of high-nickel alloys in petroleum production and in the fundamental distillation processes. This second part deals with applications of these alloys to combat specific corrosion problems in a variety of refinery treating processes and also discusses the selection of materials for high-temperature applications in refinery and associated petrochemical processes. ***G. L. Swales.*** *Corrosion Technology*, v. 6, Apr. 1959, p. 119-123.

9258* The Influence of Molybdenum on Structure and Mechanical Properties at Elevated Temperatures of Cast Nickel-Chromium Alloys Having High Strength at Elevated Temperatures. Experimental melts—microstructure and heat treatment of the different groups of materials—mechanical properties—creep strength as dependent on time. (*In German.*) Der Einfluss von Molybdän auf das Gefüge und auf die mechanischen Eigenschaften bei hoher Temperatur in gegossenen, hochwarmfesten Nickel-Chrom-Legierungen. ***Karl Roesch and Hans Zeuner.*** *Giesserei*, v. 46, no. 9, Apr. 23, 1959, p. 202-215.

9259* Economical Austenitic Stainless Steels Based on Cr-Mn-Ni-N Alloy. Based on the reports in the literature and on the authors' investigations, they have developed an economical Cr-Mn-Ni-N austenitic steel. The results of the research work have been tested with two melts, each giving a yield of 3 tons. The steel produced shows a stable austenitic structure not only at normal temperature but also at temperatures up to 1230 C. (*In Czech.*) Úsporné austenitické nerezavějící ocele Cr-Mn-Ni-N. ***Karel Hýbek, Jan Solc, and Marcela Zezulová.*** *Hutnické Listy*, v. 14, no. 4, Apr. 1959, p. 287-296.

9260 Are American Steel Methods Growing Old? State-of-the-art article. The press has stated that while Britain, Sweden, West Germany, France, and Russia develop and adopt the latest steel processes, the U. S. clings to recently-outdated methods. An authority on the subject takes the opposite view on American steel. ***James B. Austin.*** *Industrial Research*, v. 1, no. 1, Jan. 1959, p. 19-28.

9261 Four New Stainless Alloys. Describes a new series of Mo-containing 18-8 type stainless steels to be known as "PH-55 alloys". ***Norman S. Mott.*** *Iron Age*, v. 183, no. 16, Apr. 16, 1959, p. 118-121.

9262 Comparable Tool Steel Brands. Cross index of brands that carry AISI type designations. *Iron Age*, v. 183, no. 18, Apr. 30, 1959, p. 119-124.

9263 Steelmaking/U.S.A. The history of steelmaking in the United States is a fascinating story of determination, sudden tragedy, exploitation, and inventive genius rolled into one gigantic plot. The author's interpretation of the progress made in the last 100 years is presented in a series of four articles. ***Leo F. Reinartz.*** *Journal of Metals*, v. 11, Apr. 1959, p. 261-264.

9264* Metals and Alloys of the Platinum Group. ***Ernst Raub.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 3-18.

9265* Tungsten Alloys of High Melting Point. ***R. Kieffer, K. Sedlatschek, and H. Braun.*** *Journal of the Less-Comomn Metals*, v. 1, no. 1, Feb. 1959, p. 19-33.

9266* Techniques Used in Alloy Investigations at Temperatures Above 1200° C. Problems related to U and Th and their alloys. ***J. R. Murray and G. K. Williamson.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 73-76.

9267* Arc Furnace and Electron Bombardment Techniques Used in Studies of the Refractory Metals. ***F. O. Jones, A. G. Knapton, and J. Savill.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 80-84.

9268 Aluminium and Its Alloys in 1958. Some Aspects of Research and Technical Progress Reported. Attention is drawn to work published in England and the U.S.A., reporting research and technical progress in the various aspects of the metallurgy of aluminium and its alloys, including extraction, founding, fabrication, constitution, properties, corrosion and protection, applications, and standards. ***E. Elliott.*** *Metallurgia*, v. 59, Mar. 1959, p. 109-116.

9269 Niobium (Columbium)—Its Future Prospects. Sources of Nb(Cb), up to recently a less common metal, are now plentiful; rapid strides in methods of ore concentration and in its extractive metallurgy have made the metal and its alloys

readily accessible to the designer as an engineering material of importance. There are signs of progress in the development of Nb-based "super alloys" for gas turbine and rocket applications, as well as of its growing use in the steel industry, and in the electronic and nuclear engineering fields. Estimates are given on past and possible future consumption of Nb in its various fields of application and some results of recent research are reviewed. ***J. Sandor.*** *Metallurgia*, v. 59, Apr. 1959, p. 185-194.

9270* Research Program Is Giving the Lead Industry a Boost. Any research that can come up with Pb alloys having improved physical properties could have great impact on the use of Pb. The physical properties of Pb are limiting factors in many applications such as chemical equipment, cable sheathing and building construction. While a tremendous amount of work on Pb alloys has been done in the past, application of new concepts in metallurgy may lead to favorable results. ***Robert L. Ziegfeld.*** *Metals*, v. 29, Apr. 1959, p. 12 + 1 page.

9271* Still Another Threshold. Our designs for high temperatures are limited by a list of construction materials that shrink rapidly as the temperature of the environment increases. The term "high temperatures" has a different meaning to different persons, of course. In the immediate past, aircraft frame designers rarely had to cope with temperatures higher than 400 F. The boost-glide re-entry vehicles of the immediate future, however, will need to endure local temperatures of 20,000 F with comparable high heating rates. The "high temperatures" of many other functions are similarly widely separated. For this article, therefore, "high temperature" is defined as the upper range that can be endured by our most resistant construction materials. The range from 1,000 to 10,000 F then becomes our conquerable frontier. ***D. R. Williamson.*** *Mines Magazine*, v. 49, Apr. 1959, p. 15 + 4 pages.

9272* Beryllium—Past, Present and Future. Developing an economic domestic supply of beryllium is not going to be easy. Remunerative rewards are highly speculative and will depend on hypothetical demands for uses that are still in experimental stages. However, this is not a new situation to miners and metallurgists, as many metals have passed through similar development periods. ***Charles T. Baroch.*** *Mines Magazine*, v. 49, Apr. 1959, p. 19-22.

9273* Big Obstacles Beset Aluminum Food Cans. Giant obstacles thwart Al's use in volume processed food canning. Canners Association convention paper by American Can Co. technicians sees need for heavier gages to prevent panelling and buckling of Al. Present can making and filling machinery might be too hard on Al. The stronger, Mg-bearing alloys drastically reduce shelf life. ***L. P. Gotsch, E. F. Eike, and K. W. Brighton.*** *Modern Metals*, v. 15, no. 3, Apr. 1959, p. 60 + 3 pages.

9274 The Symposium on "Iron and Steel Industry in India". Nine papers: The role of National Metallurgical Laboratory in Ferrous Metallurgical Research and Development in India; Trend of Steel Demand in India; Studies in the Sintering Permeability and Pellet Strength of Australian Hematite Ores; Developments in Blast Furnace Practice; Iron Pretreatment Research; Blast Furnace Burden Preparation With Reference to High-Ash Coke; Experience With Low Shaft Furnace at Ougree; On the Bottom Blown Processes and the LD-AC Process; and Steelmaking by Injection of Oxygen and Lime-Powder-IRSID-O.L.P. Process. *NML Technical Journal*, v. 1, no. 1, Feb. 1959, 126 pp.

9275* The Dependence of Modern Technology on Alloys. The Haynes Stellite Story. *Norelco Reporter*, v. 6, no. 1, Jan.-Feb. 1959, p. 14-15.

9276 Silicon Alloys Can Replace Beryllium. . . . in spot-welding electrodes and other applications requiring a deoxidized metal with high electrical conductivity and hardness. Italian engineers claim to have developed two new alloys; one in which Si (0.48%) takes the place of Be in a standard Cu-Co-Be electrode material; the other in which 0.12% Si and 0.70% Cr are combined with Cu. Both alloys show an electrical conductivity better than 50% that of electrolytic copper, and a Brinell hardness of 10-220 after heat treatment (at 1680 F for ½ hr; followed by quenching and aging at 930 F for 2 hrs). Futhermore, these alloys are easy to produce, and do not require deoxidizers in the relatively large amounts needed for the beryllium composition. *Product Engineering* (Design Digest Issue), v. 30, no. 19, May 11, 1959, p. 22.

9277 Super-Pure Aluminum Has Been Prepared. This material, with metallic impurities held to less than 3 ppm and carbon to less than 5 ppm, shows "considerable improvement in corrosion properties in alkaline and various acid solutions". However, in water under pressure at 400 F (a common condition in nuclear reactors), it deteriorates rapidly. The method used to produce this super-pure metal is a combination of zone refining and vacuum melting, with 99.99% Al as starting point. Compared to 99.99% Al, the new material shows the expected decrease in hardness, and is also lower in strength. *Product Engineering* (Design Digest Issue), v. 30, no. 19, May 11, 1959, p. 22.

9278 Zirconium. A Review and Summary of Published Data. Properties, structure, working, and fabrication of Zr and its alloys. ***H. Loevenstein and H. L. Gilbert.*** *U. S. Atomic Energy Commission, AECU-3818*, Oct. 1958, 227 pp. (UF767 U3au Contin.)

9279 Development of Iron-Aluminum Base Alloys for Gas Cooled Reactor Components. A program was undertaken to develop an Fe-Al base alloy for service approaching 1600 F. The program includes development of an alloy, development of techniques for fabricating fuel elements, reprocessing investigations and irradiation testing of Fe-Al base alloys. ***J. Mueller.*** *U. S. Atomic Energy Commission, MND-DB-2522*, June 1958, 76 pp. (UF767 Un3.1mn Contin.)

9280 Uranium and Thorium. A comprehensive study of U and Th, giving their occurrence and extraction, their chemical and physical properties, and their uses in the Atomic Energy Industry. ***L. Grainger.*** 204 pp. 1958. Pitman Publishing Corporation, New York. (QD 181.U7-G76u)

9281 Watkins Cyclopedia of the Steel Industry. This seventh edition of Watkins Cyclopedia of the Steel Industry has been prepared to be the current reference on the activities of the steel producing and processing industries. Includes coal and coke data—production of coke and recovery of primary coal chemicals—nitrogen plant at Geneva Works, Columbia-Geneva Division, U. S. Steel Corp.—present and potential ore sources—electric pig iron furnace—control of additions and teeming—steel plant oxygen supply—gaging in rolling, heat treatment, forging, rolling, steel making operations, welding, etc. 7th Ed. 529 pp. 1959. Steel Publications, Inc., Pittsburgh, Pa. (TN705 W32)

METALS—CORROSION

9282 Oxidation of Manganese in the Air at High Temperatures. Oxidizing of electrolytic 99.9% pure Mn plates at temperatures between 400 and 1200 C. Variation of Mn_2O_3 and Mn_3O_4 layers as a function of temperature and in relation to the total thickness of the film. The oxidation process is characterized between 400 and 900 C by an activation heat equal to 29,200 cal/mole, and between 1000 and 1200 C by an activation heat of 79,800 cal/mole. (*In French.*) Sur l'oxydation du manganèse dans l'air aux température élevées. ***J. Paidassi and A. Echeverría.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 293-296.

9283* The Growth and Scaling Characteristics of Cast Irons in Air and Steam. Growth and scaling results in air temperatures up to 500 C (932 F) for periods up to 64 weeks, and in steam at temperatures up to 427 C (800 F) for periods up to 49 weeks, are reported for 35 cast irons. These include flake graphite cast irons, nodular graphite cast irons, and a blackheart malleable cast iron. Tensile and hardness tests were also carried out on specimens subjected to growth tests. The results show that cast iron is structurally stable and not subject to growth at temperatures up to 400 C (752 F) in air and steam for the periods of test given above. It appears from these results that the present limiting temperature of 232 C (450 F) for cast iron in steam applications is too low and 343 C (650 F) appears to be a more realistic temperature. ***G. N. J. Gilbert.*** *B.C.I.R.A.*

Journal of Research and Development, v. 7, no. 10, Feb. 1959, p. 478-566.

9284 Some Experiments on Internal Oxidation of Nickel Chromium Alloys. Exposure to carbon monoxide at 1750 F was found to cause rapid simultaneous carburization and internal oxidation of some Ni-Cr alloys. The addition of Fe and Si to the alloys slowed the attack. The addition of 2% Cb or 2% Ti prevented the attack completely. Some comments are made about mechanism. ***H. R. Copson and F. S. Lang.*** *Corrosion*, v. 15, Apr. 1959, p. 44-48.

9285 The Effect of Sigma Phase vs Chromium Carbides on the Intergranular Corrosion of Type 316 and 316L Stainless Steel. A detailed survey of the literature. The survey showed that at least eight different acids can cause intergranular corrosion of austenitic stainless steels if a continuous carbide network is present: acetic, hydrofluoric, hydrochloric, lactic, nitric, phosphoric, sulfurous and sulfuric acid. Only limited information was available on the effect of sigma phase on the intergranular corrosion resistance of stainless steels in these same acid environments. ***Donald Warren.*** *Corrosion*, v. 15, Apr. 1959, p. 63-70.

9286* Impressions of Russian Corrosion Research. The authors attended a corrosion conference in Moscow and present some of their impressions in this article. ***J. B. Cotton and E. C. Potter.*** *Corrosion Technology*, v. 6, Apr. 1959, p. 117-118.

9287 Oxidation Studies on the Iron-Chromium-Aluminum Heater Alloys. The oxidation behavior of three Fe-Cr-Al alloys was studied, using sensitive weight gain techniques. In addition, X-ray diffraction methods were used to determine the crystal structure and composition of the oxide films. The adhesion characteristics of the oxide film to the metal were tested by introducing strains into the metal oxide system during oxidation. Strain oxidation studies showed the oxide scale on the high Al alloy to be less susceptible to damage than the lower Al content alloys. These studies were correlated directly with practical performance tests. ***Earl A. Gulbransen and Kenneth F. Andrew.*** *Electrochemical Society, Journal*, v. 106, Apr. 1959, p. 294-302.

9288 Electrochemical Aspects of Stress Corrosion. In recent years, there has been some discussion of a "mechanical" mechanism for stress-corrosion cracking. In much of this work, discussions of mechanism are based on the combination of a mechanical step and an electrochemical sten, these being regarded as alternate and discrete actions which contribute to the total phenomenon. Those holding this viewpoint with respect to the mechanism of stress-corrosion believe that purely mechanical cracking is the major contribution toward stress-corrosion cracking, and that electrochemical reaction or corrosion acts only as a means of triggering the mechanical cracking. ***D. K. Priest.*** *Electrochemical Society, Journal*, v. 106, Apr. 1959, p. 358-362.

9289* Anti-Corrosive Finish to Ferrous Metals. A highly effective anti-corrosive finishing process for application to ferrous metals has been demonstrated. Known as Bostik "Endurion", this process was first developed in the U.S.A., where the treatment is specified for various components of ordnance equipment, guided missiles, and nuclear-powered submarines, and it is also being used by a number of large American manufacturing organizations. *Industrial Finishing (London)*, v. 2, Apr. 1959, p. 53 + 1 page.

9290* Study on the Oxidation Resistance of Zirconium. ***Jin-ichi Takamura and Yasuo Sasaki.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 58, Mar. 1959, 16 pp.

9291 Ignition of Titanium. Titanium burns under certain conditions while it is stable in air; the newly discovered characteristic must be considered where oxygen content and pressure are high. *Light Metal Age*, v. 17, Apr. 1959, p. 6-7.

9292 Studies on the Dry Corrosion of Nimonic 80A by Peat Ash. An account is given of the effects of typical peat ashes on Nimonic 80A at temperatures of 700-800 C. Previous work on related aspects of the dry corrosion of high-Ni alloys is reviewed. The present study confirms the opinion that the form of accelerated oxidative corrosion considered is preceded by sulfidation, particularly when alkali sulfate/chloride mixtures are involved. A critical examination of the process, using metallographic and X-ray diffraction techniques, is reported which indicates that when Nimonic 80A is subjected to these mixtures at elevated temperatures, the sulfidation process leads to the formation of CrS and Ni_3S_2 ahead of the oxidation front. ***J. A. Waddams and J. C. Wright.*** *Metallurgia*, v. 59, Apr. 1959, p. 161-164.

9293* Metal Corrosion at High Temperature Due to Vanadium Dioxide. V. Mechanical Properties and Behavior of Fe-Al-Ti Alloys. A study of the effect of increasing Al contents on the oxidation resistance of iron in the presence of vanadium dioxide vapor. "Thermenol" (Fe, 10-18% Al 2-4% Mo) is suggested as an excellent refractory alloy in spite of possible heavy grain growth at high temperature and poor workability at low temperature. (*In Italian.*) Sulla corrosione dei metalli ad alta temperatura, da parte dell' anidride vanadica. ***Aurelio Burdese and Sergio Gallo.*** *Metallurgia Italiana*, v. 51, Feb. 1959, p. 65-71.

9294* Oxidation of Titanium Metal and Titanium-Aluminum Alloys. Authors determined the oxidation rates of Ti metal and its alloys containing 1-8% of Al by a quartz-spring balance at a temperature between 907-1041 C, and found that the oxidation rates of this metal and these alloys, except for the alloy containing 1% of Al, followed the parabolic rate law after 100 minutes oxidation. Oxidation products were examined by a microscope and X-ray photograph. Scales consisted, for the most part, of TiO_2. The experiments of reoxidation of oxidized specimens showed that the thickness of TiO_2 was the rate controlling element of oxidation by diffusion mechanism. The experiments by marker showed that Ti ions diffused through TiO_2 layer from the metal-oxide interface to the oxide-gas interface. ***Masao Adachi and Tokuzō Tsujimoto.*** *National Research Institute for Metals, Transactions*, v. 1, no. 1, 1959, p. 32-38.

9295 The Corrosion Resistance of and an Evaluating Method for Various Electrodeposits on Steel. A comparison of the corrosion resistance of electroplated zinc, cadmium, tin and tin-zinc alloy deposits in thicknesses of 2, 5 and 10μ was made by means of salt spray, humidity, sulfur-dioxide carbon-dioxide, and outdoor exposure tests. ***Heinz W. Dettner.*** *Plating*, v. 46, May 1959, p. 469-480.

9296 This Test for Oxidation Resistance. A new technique probes under surface oxide for clues to alloy performance at air temperatures up to 2200 F. A metallographic technique, which probes beneath the surface to measure and survey damage done by oxidation. Although the Ni- and Co-base superalloys cannot stand high stress situations at much above 1800 F, rapid advances in space-vehicle design show they have great potential to 2200 F, if stresses are kept low. ***Rod Simenz.*** *Product Engineering*, v. 30, no. 17, Apr. 27, 1959, p. 48 + 2 pages.

9297 Corrosion of Type 316 ELC Stainless Steel in Fluoride-Bearing Zirconium Process Wastes. ***T. L. Hoffman and C. M. Slansky.*** *U. S. Atomic Energy Commission, IDO-*14449, Jan. 9, 1959, 23 pp. (UF767 Un3.1id Contin.)

9298* Problems in Stainless Steel Welding Regarding Intercrystalline Corrosion. After describing various heat treatments and their effects on welded austenitic steel structures such as stabilized steel 17 246, a detailed draft of procedures for testing intercrystalline corrosion resistance of the welds is indicated. The three essential ways of automatic fusion welding (Unter Flux, argon- and Co_2-shielded) with a view to attaining perfect stabilization of the weld metal, are compared. (*In Czech.*) Problémy svařování antikorozních oceli z hlediska mezikrystalové koroze. ***Josef Němec.*** *Zvaranie*, v. 8, no. 3, Mar. 1959, p. 74-78.

See also: **9517** (corrosion of extruded Al alloy powders).

METALS—EXTRACTION AND REFINING

9299 The Role of High-Purity Oxygen in Metallurgical Processes. Presents a description of the important metallurgical applications of high-purity tonnage O in Fe and steel opera-

tions. Consumption of manufactured O in the American steel industry has mounted steadily during the past ten years to its present record level of 26 billion cubic feet annually, or more than 230 cubic feet of O for each ton of steel produced. The major influences in this development are: (1) widespread use of injected O for C reduction in refining open hearth and electric furnace heats; (2) selective utilization of gaseous O for flame enrichment during meltdown in the open hearth; (3) improved metallurgy made possible by use of O in the production of stainless grades; (4) new large-scale uses for metallurgical O, including the top-blown basic O steelmaking process and O enrichment of blast furnace air. ***H. B. Emerick.*** *Blast Furnace and Steel Plant*, v. 47, May 1959, p. 463-477.

9300* Bibliography on Extractive Metallurgy of Nickel and Cobalt, 1900-1928. ***Curtis A. Jones.*** 33 pp. 1959. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (ZTN758 Un3.5b Ref.)

9301* Vacuum-Melting of Metals. Arc-melting and induction-melting furnaces now in operation at the Sheffield works of Jessop-Saville, Ltd., constitute the largest plant outside America for melting in vacuum. The furnaces are being used particularly for Ti and Zr, but also for improving characteristics of existing steels and developing new alloys. *Engineer*, v. 207, Apr. 17, 1959, p. 607-608.

9302 The Preparation of High-Purity Plutonium Metal. High puri.y α-phase plutonium metal was produced by a process which consisted of two successive peroxide precipitations, direct hydro-fluorination with gaseous HF, and reduction to metal with Ca and iodine "booster". ***K. W. R. Johnson.*** *Journal of Inorganic and Nuclear Chemistry*, v. 9, nos. 3/4, Mar. 1959, p. 200-203.

9303 LD Operations at Aliquippa. Basic oxygen steelmaking has been going on at J & L's Aliquippa works since November 1957. Report shows the remarkable production records being chalked up by this relatively new process. ***D. R. Loughrey.*** *Journal of Metals*, v. 11, Apr. 1959, p. 256-260.

9304 Electric Direct-Reduction Process Produces Steel or Pig Iron. A new steelmaking process, making use of a double-hearth, low-frequency induction furnace for the production of pig iron or steel, can produce high-quality and alloy steels. ***Albert de Sy.*** *Journal of Metals*, v. 11, Apr. 1959, p. 265-269.

9305 Zinc Blast-Furnace Operation. The lead splash condenser, developed by Imperial Smelting, has permitted Zn to be condensed from blast-furnace gas high in CO_2. ***S. W. K. Morgan and J. Lumsden.*** *Journal of Metals*, v. 11, Apr. 1959, p. 270-275.

9306* Zone Refining of Molybdenum. The electron bombardment floating zone melting method was applied to refining molybdenum. ***J. A. Belk.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 50-55.

9307* The Zone Melting of Refractory Metals Including Rhenium and Tungsten. ***G. A. Geach and F. O. Jones.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 56-59.

9308* Arc-Melting Processes for the Refractory Metals. Both consumable and "nonconsumable electrode" processes are discussed. Also, the plasma-jet projector and constricted arc torch are discussed. ***A. R. Moss.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 60-72.

9309 Ingot Moulds. Mold types; cast iron, copper, and miscellaneous molds. ***J. C. Wright.*** *Metal Industry*, v. 94, Apr. 24, 1959, p. 323-326.

9310 Vacuum Melting Special Alloys. Vacuum melting will not satisfy all the demands made by the engineer, but it does represent a considerable advance in many metallurgical problems, and in steel melting, as well as the newer nonferrous alloys, the process has shown advantages. *Metal Industry*, v. 94, Apr. 24, 1959, p. 326 + 2 pages.

9311 Expansion of Spanish Steel Industry—New ENSIDESA Melting Shop at Aviles Commissioned. An important step in the expansion of the Spanish steel industry has recently taken place with the commissioning of the three 350-ton tilting open hearth furnaces in the melting shop of the new integrated iron and steelworks at Aviles on the Asturian coast. *Metallurgia*, v. 59, Mar. 1959, p. 139-140.

9312 Regenerators and Preheat Temperatures. A Regenerator Group was formed in January 1957 to summarize the present knowledge of regenerator theory and practice, and indicate what further gains in furnace performance might be achieved by improvements in regenerator efficiency. A report which contains a critical survey of experimental work on open-hearth regenerators, a review of theoretical and experimental work on heat transfer, and a recommended method of calculating heat transfer in a regenerator, "Open-Hearth Furnace Regenerators: a Survey of Theoretical and Experimental Work with Recommendations for the Calculation of Preheat". *Metallurgia*, v. 59, Mar. 1959, p. 143.

9313* For Smelting . . . 3 Ways to Use a Fluid Bed Reactor. A discussion of three United States patents for the reduction of Fe, Pb, and Zn ores or concentrates to metals in view of advanced technology in the use of the fluidizing technique. ***Sigmund L. Smith and Fred L. Stubbs.*** *Mining World*, v. 21, no. 6, May 1959, p. 42-43.

9314* Mastering Production of Transformer Steel. Production process for manufacturing transformer steel with the use of O and vacuum treatments. (*In Russian.*) Osvoenie vyplavki transformatornogo metalla. ***N. V. Keis, D. G. Zhukov, and A. M. Khizhnichenko.*** *Stal'*, v. 19, no. 2, Feb. 1959, p. 130-131.

9315* Determination of Active Weight of Burden in an Operating Blast Furnace. The results of experimental determinations of the values of vertical pressure, produced by the blast-furnace burden at different levels, coincide satisfactorily with the calculated data, obtained according to the method, developed on the basis of the well-known Jansen's equation. (*In Russian.*) Opredelenie aktivnogo vesa shikhty v deĭstvuiushcheĭ domennoĭ pechi. ***N. N. Babarykin, A. A. Agashin, and F. A. Iushin.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 289-291.

9316* Investigation and Control of Blast-Furnace Process by Means of Radioactive Isotopes and Emanations. The wide use of radiometric methods in the USSR for investigation of the blast-furnace process has given substantial results. However, all the opportunities offered by application of these methods are far from being utilized completely. It is necessary to intensify research work aimed at development of new ways for the rational application of these effective methods in blast-furnace practice. (*In Russian.*) Issledovanie i kontrol' domennogo protsessa s pomoshch'iu radioaktivnykh izotopov i izlucheniĭ. ***P. L. Gruzin, V. N. Afanas'ev, and S. V. Zemskiĭ.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 291-297.

9317* High-Temperature Hot-Blast Stoves for Blast Furnaces. The arrangements of the high-temperature hot-blast stoves for large capacity blast furnaces, which were selected at the special competition, announced earlier for this purpose, may be recommended for application when designing new installations. (*In Russian.*) Vysokotemperaturnye vozdukhonagrevateli domennykh pecheĭ. ***N. D. Kirichenko and E. V. Kochinev.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 298-304.

9318* About Air Cooling of Blast Furnaces. (*In Russian.*) O vozdushnom okhlazhdenii domennykh pecheĭ. ***A. A. Razumov.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 304-305.

9319* Thermotechnical Investigation of Open-Hearth Furnace Ports When Injecting Air Into Gas Ends. The use of compressed air, preheated in a regenerator, for injection into the gas ends of an open-hearth furnace enables to reduce considerably the tap-to-tap time and to increase the furnace productivity. (*In Russian.*) Teplotekhnicheskie ispytaniia golovok s inzhektsieĭ vozdukha v gazovyĭ prolet. ***N. I. Kokarev, A. G. Kapichev, V. G. Lisienko, P. P. Semenenko, and V. G. Tiulebaev.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 306-311.

9320* The Automatic Control of Thermal Condition of Open-Hearth Furnaces at the Kuznetsk Metallurgical Combine. (*In Russian.*) Avtomaticheskiĭ kontrol' i upravlenie teplovym rezhimom martenovskikh pecheĭ *KMK*. ***M. M. Epshteĭn.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 318-320.

9321* Intensification of the Structural Electric Steel-Making Process. A considerable increase in productivity of the steel-melting arc furnaces and simultaneously a substantial improvement of metal quality were obtained by speeding up and partial combination of individual periods of heat and also by blowing O into the bath. (*In Russian.*) Intensifikatsiia plavki konstruktsionnoĭ elektrostali. ***A. M. Levin, et al.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 323-327.

9322* The Development of Metallic Manganese Production Process. The development of the process of production of metallic Mn at the Zaporozhe Ferroalloy Works (the use of tilting furnaces, liquid conversion slags, process of direct production of the conversion Mn-Si, increased working voltages and improved method of lime charging) enabled productivity of the furnaces to rise considerably and to reduce in 1958 more than three times the net cost of the manufactured product as compared with that in 1950. (*In Russian.*) Usovershenstvovanie proizvodstva metallicheskogo margantsa. ***V. S. Zel'din and L. G. Il'iushina.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 333-335.

9323 Dravo Gets American Rights to Swedish Steel Process. Rotating oxygen converter produces high quality steel; heat efficiency and output are high, and capital outlay is less than for an open hearth of the same capacity. The furnace can be used to refine high or low phosphorous ores. Oxygen content is at least as low as for open hearth steel. Phosphorous content can be kept at 0.020% or less in low carbon rimming steel for deep drawing. Nitrogen varies from 0.002 to 0.003% when lance oxygen is 95 to 96% pure; it can be as low as 0.001% when the oxygen is 99% pure. *Steel*, v. 144, Apr. 20, 1959, p. 92 + 1 page.

9324 From Iron Ore to Steel in 35 Minutes. The Madrigal process which could revolutionize steelmaking. The ore used is magnetically separated from desert sand. A one-shot steelmaking process is used by adding 600 pounds of alloyed Fe per ton of ore. Appears to be an unusual approach to direct reduction. *Steel*, v. 144, Apr. 27, 1959, p. 100-101.

See also: **9606** (self-fluxing sinter line).

METALS—FINISHING, POLISHING, AND CLEANING

9325 Surface Treatment of Aluminium. ***F. Flusin.*** *Metal Industry*, v. 94, May 1, 1959, p. 359-360.

9326* The Improvement of Surface Preparation and Its Influence on the Adherence of the Sprayed Metal. (*In German.*) Die Verbesserung der Oberflächenvorbereitung und ihr Einfluss auf die Haftfestigkeit des gespritzten Metalls. ***E. Nádasi.*** *Schweisstechnik* (Berlin), v. 9, Mar. 1959, p. 89-92.

9327* Ultrasonic-Cleaning of Fine Wire Drawing Dies. The method of cleaning diamond dies during the process of manufacture described here, which does in minutes what formerly took hours, not only has saved time, but contributes to die accuracy. The thought suggests itself that this method may have wider and other applications in the wire industry. ***John W. Cowan.*** *Wire and Wire Products*, v. 34, May 1959, p. 595 + 2 pages.

METALS—FOUNDRY PRACTICE

9328* Examining Continuous Steel Castings. A tungsten ball containing a radioactive marker is dropped into a continuous steel casting to find the lowest point where the inner metal is still molten. ***C. Varga and J. Fodor.*** *Atomic World*, v. 10, Apr. 1959, p. 142-143.

9329* Casting Steel in Re-Usable Molds Promoted by Automatic Pouring. Production casting of steel wheels for railroad cars to a dimensional tolerance on the order of one tenth of one per cent is achieved. Such precision on 700-pound castings is obtained by using permanent molds made of graphite rather than rammed sand molds. The car wheels cast in these molds are accurate enough that no machining is required except in the hub bore; and they are expected to have many times the life of conventional wheels produced in rammed sand molds. ***Gilbert C. Close.*** *Automation*, v. 6, May 1959, p. 79-83.

9330* Effect of Carbon, Silicon and Other Factors on the Shrinkage Behaviour of Grey Cast Iron. A study of the effect of C, Si and P on the shrinkage and porosity of grey cast iron. Good correlation was obtained between eutectic graphite content and shrinkage of various types. Internal porosity was absent in 0·05% P irons, but in 1% P irons it increased with increase in eutectic graphite content. Increasing eutectic graphite also enlarged the castings and a hypothesis has been advanced which suggests that this enlargement is responsible for the increase in porosity with increasing eutectic graphite content. ***T. J. Szajda.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 10, Feb. 1959, p. 567-604 + 6 plates.

9331* The Influence of Mold Rigidity, Pouring Temperature and Metal Composition Upon the Soundness of Fed Nodular and Flake Graphite Iron Castings. Substantial improvements in the yield and soundness of fed nodular graphite iron castings of the keel block type have resulted from the use of rigid cement sand molds. Comparison of mold and casting dimensions showed that in green sand molds, extensive casting expansion occurred during solidification, the expansion being associated with deep feeder-head pipes and considerable internal porosity. Similar measurements showed that rigid cement sand molds prevented casting expansion and caused a marked contraction in casting dimensions relative to the original mold dimensions. For hypo-eutectic nodular graphite irons of fixed composition and pouring temperature, there was a linear relationship between casting expansion and the quantity of feed metal required as measured by the volume of the feeder-head pipe. ***K. E. L. Nicholas.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 10, Feb. 1959, p. 605-623 + 11 plates.

9332 Brass and Bronze Foundry Practice. Presents facts and theories of brass foundry practice. The author's experience and the opinions of other leaders is presented in such form that it will be easily understood by foundry begineers. ***Harry M. St. John.*** 244 pp. 1958. The Penton Publishing Co., Cleveland. (TS565 Sa23b)

9333* Modern Concepts on Clay Minerals for Foundry Sands. The bonding capacity of various types of clay has been tested: bentonites produce the highest, fireclays moderate, and illite clays the lowest green strength. ***Franz Hofmann.*** *British Foundryman*, v. 52, Apr. 1959, p. 161-170.

9334* The Measurement and Control of Dust in Foundries. Methods of sampling respirable dust in foundries are described and the maximum, minimum, and average results are given of a comprehensive survey of dust levels in the fettling shops of 58 steel foundries. Comparisons are made between the concentration and composition of dust in fettling and molding areas respectively. The effects of meteorological conditions and general atmospheric pollution are considered. The free-silica content of steel foundry dusts is shown to be much lower than was previously thought. ***A. H. Sully, C. M. Stoch, and J. M. Slater.*** *British Foundryman*, v. 52, Apr. 1959, p. 193-211.

9335 Dynamic Loading—Its Effect on Casting Design. II. Article is the second of two in which the author discusses use of proper design to minimize stress concentration in castings which undergo dynamic loading. ***John B. Caine.*** *Foundry*, v. 87, May 1959, p. 92-95.

9336 Molding and Pouring—Large Steel Castings. Consistency and uniformity are vital in good sand practice. Every possible control should be used. Each removes another phase of guesswork or another possible variable. ***Hubert Chappie.*** *Foundry*, v. 87, May 1959, p. 96-99.

9337 Inoculation of Gray Cast Iron. Discusses theories explaining the results of inoculation, tells why inoculants are used, and does some forecasting concerning possible uses of inoculation in the future. ***Ralph A. Clark.*** *Foundry*, v. 87, May 1959, p. 100-106.

9338 Mechanized Shellmoulding in an American Foundry. Outboard Marine Corp. has developed a revolutionary scheme.

Description of Evinrude Motors' highly mechanized shellmolding foundry at Milwaukee, Wisconsin. The plant produces steel crankshafts for outboard motors and is almost fully automatic, only 20 men being employed. The various departments are considered individually, and a detailed account of the production cycle given. *Foundry Trade Journal*, v. 106, Mar. 26, 1959, p. 352-356.

9339 Investment Casting in the US and UK. II. Describes the activities of the American investment-casting industry and brings readers up to date on the current developments in high-strength and high-temperature alloys and alloy steels in America. ***Roger F. Waindle.*** *Foundry Trade Journal*, v. 106, Apr. 9, 1959, p. 409-414.

9340 Development of Corrosion-Resisting Investment Castings With Higher Mechanical Properties and Good Weldability. The demand for components, in investment-cast form, with high tensile properties has recently increased. As the scope of the lost-wax casting process has broadened, castings have been produced in a wider range of alloys, e.g., low-alloy nonstainless steels, ferritic and martensitic stainless steels, etc. This article deals with the development, by Firth-Vickers Stainless Steels, Limited, Sheffield, of the alloy FV.520. ***R. Taylor.*** *Foundry Trade Journal*, v. 106, Apr. 9, 1959, p. 414-417.

9341* Absorption of Gas From the Air and From the Combustion Gases During the Melting of Light Metal Alloys. Fundamentals of measuring the gas content; natural absorption and release of gas; process of the natural absorption of gas; critical temperature; theoretical considerations; conclusions for the practice. (*In German.*) Die Gasaufnahme aus der Luft und aus den Verbrennungsgasen beim Schmelzen von Leichtmetallegierungen. ***Claude Mascré and André Lefèbvre.*** *Giesserei*, v. 46, no. 7, Mar. 26, 1959, p. 153-158.

9342* The Penetration of Metal in Sand Cores. Configuration of the sample; composition of the sand; the steel; temperature determinations; reproducibility of the tests; results of the temperature determinations; outline and depth of the penetrations; influence of the molding sand upon the penetration of metal; theory of the penetration; conclusions. (*In German.*) Das Eindringen von Metall in Sandkerne. ***K. Fursund.*** *Giesserei*, v. 46, no. 7, Mar. 26, 1959, p. 159-164.

9343* Production of Castings With Exact Dimensions by Using Appropriate Patterns. Description of the pattern-making equipment; results obtained with similar equipment for engine cases, induction piping and oil pan; establishment of a standard specification for dimensional allowances for light metal castings; possibility of making a frame for installing the pattern. (*In German.*) Massgenaue Gusstücke durch zweckentsprechende Modelle. ***Hanns Radmann.*** *Giesserei*, v. 46, no. 7, Mar. 26, 1959, p. 164-168.

9344* A Novel Core Binder for High-Frequency Baking. Influence of intensity of field and baking temperature on core strength. (*In German.*) Ein neuartiger Kernbinder für Hochfrequenztrocknung. ***W. W. Magers.*** *Giesserei*, v. 46, no. 8, Apr. 9, 1959, p. 191-192.

9345* A New Combined Radiation-Convection Recuperator for Hot Blast Cupolas. Hot blast temperature required by cupolas—heat requirements and combustion temperature—disadvantages of high combustion temperatures—description of the radiation-convection recuperator. (*In German.*) Ein neuer kombinierter Strahlungs-Konvektions-Heisswindrekuperator. ***Gert Wellensiek.*** *Giesserei*, v. 46, no. 9, Apr. 23, 1959, p. 236-238.

9346* The Control of the Cupola Furnace. Fundamentals of the cupola control-measuring equipment. (*In German.*) Die Überwachung des Kupolofens. ***Fritz Kretzschmer.*** *Giesserei*, v. 46, no. 9, Apr. 23, 1959, p. 239-240.

9347* Order Scheduling in a Metal Foundry. General survey of duties, use of blank forms, progress of work in the departments involved, sales, work preparation, operation, testing and dispatch. (*In German.*) Auftragsabwicklung in einer Metallgiesserei. ***Artur Obergethmann.*** *Giesserei*, v. 46, no. 9, Apr. 23, 1959, p. 240-246.

9348 Packaged Foundries. As a result of the policy of producing a compact, efficient molding unit, the complete plant can be accommodated on a concrete apron approximately 30 ft. by 60 ft. ***H. B. Hallsworth, R. D. Mills, and Peter Spear.*** *Metal Industry*, v. 94, Mar. 27, 1959, p. 247-250.

9349 Guarding Die-Casting Machines. All die-casters will recognize the shortcomings of the manually-operated guard frequently fitted, in one form or another, to die-casting machines. The dependence of cycling time on the operator, the additional hazards accompanying hand-operation, all tend to encourage developments in automatic operation. *Metal Industry*, v. 94, Apr. 24, 1959, p. 328-329.

9350* Carbon Flotation in Ductile Iron. In hypereutectic ductile iron castings, carbon in excess of that necessary to maintain a carbon equivalent (C.E. = % T.C. + ⅓% Si) of 4.55%, was found to be precipitated during the solidification period. The precipitated carbon is floated to the top surface of the casting, where it is trapped, resulting in an area of high graphite nodule concentration. The flotation of carbon also occurs in the ladle in the time interval between silicon inoculation and pouring of the castings. ***A. H. Rauch, J. B. Peck, and G. F. Thomas.*** *Modern Castings*, v. 35, May 1959, p. 61-64.

9351* Timing of Expansion Scab Formation. Mold surface penetration was studied to find when expansion scabs occurred. A step casting was designed for making a buckled or expansion scabbed casting. The tests showed that one type of scabs and/or buckles occurred because of sand expansion, and occurred at the time the mold was filling, or while the metal was still in a liquid state. ***J. E. Haller.*** *Modern Castings*, v. 35, May 1959, p. 65-68.

9352* Radioisotopes Utilization in the Foundry Industry. Applications of radioisotopes in the metals industry, while relatively few in number, have contributed measurably to an improved product and a better understanding of the processes involved. These applications include measurement of wear of cutting tools, bearings and refractory surfaces, tracing of chemical and physical species through complex processes, measurement of thickness of solid and fluid metal and surface coatings, corrosion, location of alloying elements in microstructure and the diffusion of metals in alloys. ***M. Pobereskin and D. N. Sunderman.*** *Modern Castings*, v. 35, May 1959, p. 69-74.

9353* Aluminum Die Casting Metal Cost—Its Practical and Analytical Evaluation. A method of establishing the value of the separate factors contributing to the metal cost both in an over-all operation and in an individual casting is discussed. A practical review is given of practices for minimizing metal costs. ***George H. Found and John Lapin.*** *Modern Castings*, v. 35, May 1959, p. 88-92.

9354* Deoxidation Defects in Steel Castings—Final Report for the AFS Steel Division Research Committee. The three objectives of this investigation were to: (1) identify these inclusions; (2) trace their origin in foundry practice; and (3) suggest methods of elimination. ***R. A. Flinn and L. H. Van-Vlack.*** *Modern Castings*, v. 35, May 1959, p. 93-97.

9355* Cast Surfaces Evaluation for Roughness Standards. Methods of measuring machine surfaces are not applicable to castings. Foundry produced visual comparator gages for cast surfaces have been used with satisfactory results in many production applications, and have been generally accepted as the most practical method of controlling cast surfaces for the majority of casting applications. ***Eldon Swing.*** *Modern Castings*, v. 35, May 1959, p. 98-102.

9356* Porosity, Inclusions and Pinholes in Malleable Castings. An approach to the porosity, inclusions and pinhole problem in the malleable foundry is put forth. Inclusions are seldom recognized as having a direct relationship toward the creation of pinhole porosity. Hot sand and brittle sand, in the author's opinion, are the most common sources of inclusions that may create pinhole porosity in production malleable foundries. Hot sands are believed to create a chain of reactions which become difficult to control. Other reasons for porosity or pinholes in malleable castings are those of improper melting practices. Also, mold wall movement tends to aggravate a sur-

face pinhole condition. ***C. A. Sanders.*** *Modern Castings*, v. 35, May 1959, p. 103-111.

9357* Linear Programming Applied to Economic Selection of Materials for Furnace Charges. Many combinations of furnace input materials exist which will meet a set of given furnace output requirements. The linear programming technique can be used to choose that feasible material combination whose material cost is a minimum. The technique can be used to calculate optimum prescriptions for individual heats, or to determine which materials to buy to stock in inventory. This paper is concerned with the "what to buy" decision; a hypothetical problem is solved on a high-speed digital computer, and several implications relating to the problem are discussed. ***Gideon I. Gartner.*** *Modern Castings*, v. 35, May 1959, p. 112-118.

9358 Designing for Aluminum Die Casting. *Precision Metal Molding*, v. 17, May 1959, p. 39-40.

9359 Designing for Zinc Die Castings. *Precision Metal Molding*, v. 17, May 1959, p. 41-49.

9360 Designing for Investment Casting. *Precision Metal Molding*, v. 17, May 1959, p. 50-55.

9361 Designing for Permanent Mold Casting. These factors must be considered: hardness, tensile strength, impact strength elongation, dimensional stability, electrical conductivity, thermal conductivity, corrosion resistance, resistance to heat, cold flow resistance, and pressure tightness. *Precision Metal Molding*, v. 17, May 1959, p. 56-59.

9362 Designing for Plaster Mold Casting. ***W. J. Prestel.*** *Precision Metal Molding*, v. 17, May 1959, p. 64 + 1 page.

9363* Aluminum Engine. Review of possible methods of producing aluminum engines. Sand, semi-permanent mold, permanent mold, and die casting are discussed. ***George W. Niepoth.*** *SAE Journal*, v. 67, Apr. 1959, p. 88-89.

See also: **9096** (boron coal char for cupola fuel); **9248** (quality control of alloy steel castings); **9367** (vibratory aging of castings); **9581** (training foremen in British foundries); **9721** (ventilating shell-mold foundry); **9783** (design of castings).

METALS—HEAT TREATMENT

9364 Latest Developments in Heat Treating for Automotive and Aircraft Fields. III. Selective heating ability, cleanliness, and ease of working conditions are among many advantages offered to industry by induction heating process. ***Andrew W. Shearer.*** *Automotive Industries*, v. 120, no. 9, May 1, 1959, p. 40 + 7 pages.

9365 Pearlitic and Malleable Irons Heat Treated Automatically. An automatic combination annealing and heat treating plant with atmosphere control produces both high-strength pearlitic and ferritic malleable irons. ***Lawrence E. Emery.*** *Foundry*, v. 87, May 1959, p. 82-87.

9366* Furnaces for the Study of High Temperature Equilibria. Laboratory furnaces for the heat-treatment of metallurgical specimens at temperatures above 1200 C can be divided into four kinds, this division having a close relation to the temperature range for which a given type of furnace is suitable. ***C. W. Haworth.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 106-109.

9367 Artificial Ageing of Castings With Enke Vibrators. Artificial aging of castings by vibrating them on a special rig. Both natural aging and artificial aging by heating in a furnace were considered. The results obtained by vibration aging are as good as those obtained by natural aging or by heat treatment. *Machinery (London)*, v. 94, Apr. 8, 1959, p. 794-795.

9368 The Prediction of Carburizing Cycles. Discusses carburizing cycles, interpretation of case depth, measuring C potential, C solubility, equations of carburizing, carburizing rate, and high temperature carburizing. ***E. N. Case.*** *Metal Treating*, v. 10, no. 2, Mar.-Apr. 1959, p. 2 + 6 pages.

9369 Metallurgical Research Develops Improved Products Through Heat Treating. Describes research in regard to improving the quality of cross-rolled plow disc steel by austempering. ***Helen Hoover.*** *Metal Treating*, v. 10, no. 2, Mar.-Apr. 1959, p. 8 + 10 pages.

9370 Dew Point Monitoring. Round-the-clock monitoring of five endothermic gas generators and six heat treating furnaces is paying off in better quality carburizing. The atmosphere from the RX gas generators is piped into a common manifold which leads into a gas accumulator where the gases mix to form a common dew point. ***A. R. Keefe and M. R. Koehn.*** *Metal Treating*, v. 10, no. 2, Mar.-Apr. 1959, p. 22 + 1 page.

9371 High Temperature Carburising. The results of an investigation on the high temperature carburizing of a series of U. S. steels, including plain carbon, Ni-Mo and Ni-Cr-Mo types, indicate that a satisfactory grain structure can be achieved, particularly where a reheat hardening operation is used. Potential savings in time and cost are quite substantial, but control of temperature and atmosphere potential become more critical with accelerated carbon penetration. ***H. N. Ipsen.*** *Metallurgia*, v. 59, Apr. 1959, p. 176-180.

9372 Stress Relieving in Situ. Novel Use of Mineral Wool Insulation. Vessels were stress relieved by covering them with a suitable thickness of mineral wool insulation, and applying the heat within the vessels by means of electric resistance elements disposed so as to give a uniform dissipation. The merits of this method of heat treatment are considerable. Compared with the conventional technique of placing the pressure shell within a suitable furnace—where one of adequate capacity exists—this new method practically eliminates the very substantial heat capacity of the furnace fabric. Large bulky vessels constitute notoriously uneconomic furnace charges. ***J. W. Dawson.*** *Metallurgia*, v. 59, Apr. 1959, p. 183-184.

9373* Weld Hardening of High Strength Steels and Prediction of Optimum Welding Conditions. Studies on weld hardening in the heat-affected zone in arc-welded low-alloy high strength steels. Weld thermal cycles in the heat-affected zone of various welds, namely, bead, fillet, single-Vee, double-Vee, tack and arc strike, were measured with a new type of specimen, tapered in thickness along the weld line. Measurement of weld-hardening curves which indicate the relationship between the maximum hardness in the heat-affected zone and the cooling rate at 540 C, was conducted with a mild steel and six high-strength steels. Nomographs and supplementary graphs were presented to make possible an estimation of the maximum hardness in the heat-affected zone in any high-strength steel plate when welded with any combination of welding current, welding speed, preheating temperature and plate thickness. With help of the nomographs, a prediction of the optimum welding condition so that the value of maximum hardness might become smaller than a specified value, was made possible. ***Hiroshi Kihara, Haruyoshi Suzuki, and Fumihiro Kanatani.*** *National Research Institute for Metals, Transactions*, v. 1, no. 1, 1959, p. 39-64.

9374* Protecting Gas Envelopes Formed of Technical Nitrogen for Heat Treatment of Steel. In order to prevent oxidation and decarbonization of high-carbon steel, the technical N is treated by dissociated ammonia gas, which removes O completely and adds the required quantity of H. Another method of cleaning N consists in its passing through charcoal heated up to 950-1000 C. (*In Russian.*) Zashchitnye atmosfery iz tekhnicheskogo azota dlia termicheskoĭ obrabotki stali. ***L. V. Beloruchev and A. K. Shvachkin.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 354-360.

9375* Increasing the Mechanical Properties of Reinforcing Bars by Heat Treatment. The mechanical properties of the Ct.5 steel reinforcing bars may be improved considerably by hardening immediately after rolling without additional heating of metal (with subsequent high-temperature tempering), and they may be strengthened to the level which is representative for alloy steel reinforcing bars by hardening after special heating (with tempering as well). (*In Russian.*) Povyshenie mekhanicheskikh svoĭstv armaturnoĭ stali posredstvom termicheskoĭ obrabotki. ***E. S. Tovpenets, N. I. Goncharenko, A. S. Babiĭ, and G. Z. Shcherbina.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 364-367.

9376 This Part Is Hardened With Explosives. The results: Brinell hardness is raised 300 points in Hadfield Mn steel. Hardening effects can be controlled to a depth of 2 in. Deformation is minor. Tensile strength is doubled; yield quadrupled. *Steel*, v. 144, May 4, 1959, p. 84-85.

9377 The Heat-Treatment of Steel. Designed for the experienced operator as well as the trainee, the book explains what has to be done and why it is necessary. Inclusive coverage of every phase of the subject, every class of steel and its heat treatment is claimed. Chapters on new and special topics are also presented. ***Edwin Gregory and Eric N. Simons.*** 2nd Ed. 381 pp. 1958. Sir Isaac Pitman & Sons, Ltd., London. (TS320 G86h2)

9378* Types and Uses of Controlled Atmospheres. Extensive research has resulted in a better understanding of the reactions taking place between the different gases present in the furnace, and between these gases and the metals being treated. The effect of moisture and chemical elements, such as H, N, and O, on the metals being treated is now more thoroughly understood. As a result, techniques have been developed for controlling the furnace atmosphere. ***Lester F. Spencer and Charles Weiner.*** *Tooling & Production*, v. 25, no. 2, May 1959, p. 40-43.

METALS—MECHANICAL AND PHYSICAL PROPERTIES

9379 Work Softening in Irradiated Copper. The temperature dependence of the flow stress of polycrystalline Cu, both unirradiated and after neutron irradiation, was investigated by repeated testing first at temperature T_1 and then at temperature T_2. ***M. J. Makin.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 233-239.

9380 Room Temperature Deformation Processes in Zirconium. A study has been made of the deformation processes in zirconium deformed in tension and compression at room temperature. The work was performed on single crystals and large grained samples of relatively high purity with a wide distribution of crystal orientation. The only slip system observed was (1010) [1210] with a critical resolved shear stress of about 0.65 kg/mm^2 in compression. The active twin planes were (1012), (1121), (11$\bar{2}$2), and (1123). The shear magnitudes found for (1012), (1121), and (1122) twins are about 0.17, 0.22, and 0.23 respectively, and the shear directions for these planes are [1011], [1126] and [1123], respectively. ***E. J. Rapperport.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 254-260.

9381 Vapor Pressure Measurements Over Calcium, Magnesium, and Their Alloys and the Thermodynamics of Formation of $CaMg_2$. The small values for the enthalpy and entropy of formation are consistent with the view that the compound forms because of atomic size considerations. An independent check on the enthalpy of formation was made by bomb calorimetry. ***J. F. Smith and R. L. Smythe.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 261-267.

9382* On New High-Striction Alloys of the Fe-Pt, Fe-Pd, and Ni-Pd Binary Systems. Magnetostriction of Fe-Pt, Fe-Pd, and Ni-Pd has been investigated in a wide interval of concentration of Pt and Pd in Fe and of Pd in Ni. A number of alloys with maximum positive (Fe-Pt and Fe-Pd) and maximum negative (Ni-Pd) magnetostriction were found. (*In Russian.*) O novykh vysokostriktsionnykh splavakh dvoĭnykh sistem Fe-Pt, Fe-Pd, i Ni-Pd). ***Z. I. Alizade.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, v. 23, no. 3, Mar. 1959, p. 416-417.

9383* Creep Deformation of Aluminum-Copper Two-Phase Alloys. Stable, overaged two-phase Al-Cu alloys were deformed in creep at 500 and 700 F. Their creep strengths, mechanisms of deformation and recovery, types of fracture, and ductility were studied. The effects of precipitate dispersion and alloy content were examined for their effect on these properties. ***R. M. N. Pelloux, A. R. Chaudhuri, and N. J. Grant.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Translations, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 204-209.

9384* Cause of Cleavage Fractures in Ductile Materials. Experimental evidence was obtained in support of the idea that cleavage fracture can be initiated by dislocation pile-up. The high ductility of MgO crystals when tested in bending compared to their relative brittleness in tension was explained on the basis that large pile-ups are more likely in a tension specimen. ***J. Washburn, A. E. Gorum, and E. R. Parker.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 230-237.

9385* Porosity in Formed Titanium. Strain-induced porosity has been found to occur in Ti and other materials at tensile strains greater than the uniform elongation of the material. Porosity in Ti increases with increasing strain and temperature, being most severe at 300 to 800 F. Strain-induced porosity is believed to be a normal part of the mechanism of deformation in ductile materials. ***R. A. Wood, D. N. Williams, H. R. Ogden, and R. I. Jaffee.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 308-315.

9386 Notch Ductility of Mild-Steel Weld Metal. Gives the results of some work carried out for the B.W.R.A. to provide the means for comparing the brittle fracture tendency of different mild-steel weld metals, among themselves and with plate materials in common use. The results provide Charpy V-notch impact data for positional welds made with electrodes from Classes 1, 3, and 6. The normal tensile data for these deposits are given, as well as hardness surveys, chemical analyses, and the results of micro-fissure surveys. The superior transition characteristics of the Class 1 weld metal is offset by its much higher fissure density, compared with the Class 6 weld metal. Attention is drawn to this and other factors involved when considering the problem of brittle fracture in welded platework structures. ***F. Watkinson.*** *British Welding Journal*, v. 6, Apr. 1959, p. 162-174.

9387 Mechanical Properties of Metal-Arc Welds in Galvanized Mild Steel. The effect of welding on galvanized plate and sheet was investigated by tensile, bend, hardness and impact tests. The galvanizing appeared to make hot cracking slightly worse, to reduce the severity of fissuring, and to have no effect on the microstructure. ***P. W. Jones.*** *British Welding Journal*, v. 6, Apr. 1959, p. 175-180.

9388 Delayed Failure of High Strength Steels. Tests were made to determine the effect of H concentration and notch radius on the delayed failure of aircraft quality SAE-AISI 4340 steel samples. The kinetics of crack initiation and propagation were studied by an electrical resistivity method. A new recovery treatment was developed to solve this problem without increasing baking times on temperatures for thicker plates. ***Alexander R. Troiano.*** *Corrosion*, v. 15, Apr. 1959, p. 57-62.

9389* Effects of Ordering on the Magnetic Properties of a Binary Ferromagnetic Alloy. Application of Bogoliubov's variation theorem to the evaluation of the temperature and field dependence of the anisotropy constants of ferromagnetic alloys when the degree of ordering was calculated. Qualitative agreement of theory with experimental data and partial agreement with the abnormal pattern of temperature of a disordered alloy. (*In Russian.*) O vliianii uporiadocheniia na magnitnye svoĭstva binarnogo ferromagnitnogo splava. ***Ian Shi.*** *Fizika Metallov i Metallovedenie*, v. 7, no. 2, Feb. 1959, p. 161-168.

9390* The Magnetic Properties of Cast Iron as Dependent on the Accompanying Elements, Structure and Temperature. Magnetic measurements—fabrication and preparation of the test bars—measuring principle of the light indicator magnetometer—relationship between chemical composition, structure and magnetic properties—magnetic properties of cast iron as dependent on the primary and secondary structure—influence of temperature. (*In German.*) Die magnetischen Eigenschaften von Gusseisen in Abhängigkeit von Begleitelementen, Gefügeausbildung und Temperatur. ***Anton Königer.*** *Giesserei*, v. 46, no. 9, Apr. 23, 1959, p. 216-228.

9391* New Impact Tester Checks Metal Fatigue. To obtain knowledge of materials used in constructing engines and fast thermal machines, French scientists have built a machine for testing metals under repeated shocks. How the machine works

and test results are described. ***S. J. Ziembinski.*** *Industrial Science and Engineering*, v. 6, no. 4, Apr. 1959, p. 22-27.

9392* Influence of Sulphur and Oxygen on Red-Shortness of Steel. Sulphur causes red-shortness in two separate ways: by hardening the austenite and by forming intergranular sulphide precipitates. Both phenomena lead to intercrystalline fracture. Oxygen alone does not induce red-shortness. Influence of manganese and of heat treatment. ***A. Josefsson, J. Koeneman, and G. Lagerberg.*** *Jernkontorets Annaler*, v. 143, no. 2, 1959, p. 53-75.

9393 Saturation Magnetization and Curie Points in Dilute Alloys of Iron. Methods of determining spontaneous magnetization and Curie temperatures with precision of one part in 30,000. ***Anthony Arrott and J. E. Noakes.*** *Journal of Applied Physics*, (Supplement), v. 30, Apr. 1959, p. 97S-98S.

9394 Saturation Magnetization and Ferromagnetic Interaction in Terbium Metal. The magnetic moment of Tb metal was measured at 295, 100, 4.2, and 1.25 K in applied magnetic fields up to 70,000 gauss. ***Warren E. Henry.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 99S-100S.

9395 Effect of Chemisorbed Hydrogen on the Magnetization of Nickel at Low Temperatures. The saturation magnetization of nickel particles in the range 10-100 A has been determined by extrapolating from magnetizations measured at 4.2 K in fields up to 10^4 oersteds. ***Robert E. Dietz and P. W. Selwood.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 101S-102S.

9396 Temperature Dependence of the Magnetic Properties of Nickel-Iron Alloys. The effect of temperature on the magnetic properties of six commercially available nickel-iron alloys is reported for the temperature range −60 to +250 C. The trade names of the alloys are: Hipernik, Deltamax, Hipernik V, Supermalloy, 4-79 Mo-Permalloy, and Hymu 80. ***J. J. Clark and J. F. Fritz.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 105S-107S.

9397 Effects of High Temperature on Magnetic Properties of Core Materials. An experimental study was made of the effects of temperature on the dc and 60 cps magnetic properties of the following alloys: Orthonol, 4-79 Mo Permalloy, AEM 4750, L- and Z-Silectron, Transformer A, Audio Transformer A, 11.7 Alfenol, 15.5 Alfenol, Thermenol, 7-70 Perminvar, and Supermendur. ***Michael Pasnak and R. H. Lundsten.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 107S-108S.

9398 Effect of Magnetic Annealing on the Properties of (110) [001] Oriented 3¼% Silicon-Iron Strip. Polycrystalline 3¼% Si-Fe strip with (110) [001] texture was heat-treated in a magnetic field. Both ac and dc properties were investigated before and after magnetic annealing with the field parallel to the (100), (110), and (111) directions. Distinct improvement in properties was obtained, particularly in the directions that more nearly coincide with the direction of the applied field. The anisotropy energy that arises from the magnetic annealing is about 900 ergs/cm^3, which is but a small fraction of the magnetocrystalline anistropy energy of this material. ***H. C. Fiedler and R. H. Pry.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 109S-110S.

9399 Influence of Various Heat Exposures on Alnico V Magnets. Alnico V magnets were exposed to temperatures between 350 and 550 C for as long as 1000 hours. Remanence was determined at room temperature intermittently during the exposures. The changes in remanence appeared to be caused by metallurgical as well as magnetic processes. The two effects were separated and it was found that the Alnico V material responds to temperatures as low as 350 C. ***Rudolf K. Tenzer.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 115S-116S.

9400 Effect of Neutron Irradiation on the Magnetic Properties and Degree of Order of Magnetic Metal Alloys. Sixty-cycle sine current hysteresis loops were made on thermally treated Permalloy type material both prior to and following neutron irradiation. In all cases the hysteresis loops of the irradiated alloys resembled the constricted loops characteristic of partially ordered Ni_3Fe. The effect of the sample temperature during irradiation on the magnetic properties suggests that ordering results from diffusion of vacancies. ***A. I. Schindler, E. I. Salkovitz, and G. S. Ansell.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 282S-283S.

9401 Tensile Testing Machine for Microscopic Specimens. The problems of the mechanical testing of whiskers and thin films having gage lengths down to 0.2 mm and cross-sections as low as 8×10^{-7} mm^2 are discussed. A machine is described which gives load-strain curves for such specimens with minimum load increments of 0.5 mg and with extension readings repeatable to 0.019μ. A torsion balance applies and measures the load and the strain is obtained by a null method using a marker and a special optical arrangement in a projection microscope. A number of special design features are incorporated to ensure high stability. ***D. M. Marsh.*** *Journal of Scientific Instruments*, v. 36, Apr. 1959, p. 165-169.

9402 Metal Fatigue. Fatigue is a critical problem involving vital economic and safety considerations with which the engineer must constantly deal, based usually on the tenuous course of "know-how". Recently, concepts and techniques have been developed which can be of immediate use and which also should point the way to future developments. ***George Sines and J. L. Waisman, editors.*** 415 pp. 1959. McGraw-Hill, New York. (TA460 Si63m)

9403* Effects of Purities of Raw Materials and Melting Method on the Properties of Nickel-Chromium Alloys. Nickel-chromium alloys and Nimonic 80-alloys were prepared by using raw materials of various purities and melting rapidly or slowly in a Tammann furnace. Mechanical and metallographical tests were made on the alloys. ***Renpei Yoda.*** *National Research Institute for Metals, Transactions*, v. 1, no. 1, 1959, p. 27-31.

9404 Theory of Ultrasonic Absorption in Metals: The Collision-Drag Effect. ***T. Holstein.*** *Physical Review*, v. 113, 2nd ser., no. 2, Jan. 15, 1959, p. 479-496.

9405* Electrical and Thermal Conductivity of Monovalent Metals; the Influences of Coulomb Interaction. The electrical and thermal conduction phenomena are discussed by taking account of the effects of Coulomb interaction and Umklapp processes of electron-phonon collisions. The contributions of electron binary collisions through screened short range Coulomb potential to a relaxation process are evaluated. The effect to the coupling parameter of electron-phonon interaction is also considered in the range of called Umklapp process. ***Tadao Kasuya and Kazuo Yamada.*** *Physical Society of Japan, Journal*, v. 14, Apr. 1959, p. 416-435.

9406* Influence of Order-Disorder on Creep of a Superlattice Alloy. Studies on Ni_3Fe alloys. ***Taira Suzuki and Mikio Yamamoto.*** *Physical Society of Japan, Journal*, v. 14, Apr. 1959, p. 463-472.

9407 Properties of Extruded Alloys. Properties of austenitic and martensitic stainless steels, and carbon and alloy steels. *Precision Metal Molding*, v. 17, May 1959, p. 67.

9408* Effects of Hot Working Conditions on the Characteristics of A-U4SG Alloy. I. The properties of A-U4SG alloy can be strongly influenced and even completely altered by the conditions governing the fabricating stage. In the case of extruded products, the homogenizing treatment before extruding as well as the temperature at which the extrusion is carried out are factors which make it possible to get a whole range of properties in connection with the structural condition of the metal. In the case of forgings, the author has determined fabricating conditions which make it possible to obtain products with a reduced anisotropy of mechanical properties. (*In French.*) Influence des conditions de travail a chaud sur les caractéristiques de l'alliage A-U4SG. I. ***Roger Develay.*** *Revue de l'Aluminium*, v. 36, no. 262, Feb. 1959, p. 193-197.

9409* Surface Film May Be Clue to Low Wear of Alloy CI Tappets. High contact load tests with the tappet test machine indicate that the formation of a visible surface film may explain why hardened alloy cast iron tappets wear better than carburized steel ones. ***George H. Robinson, Robert F. Thomson, and Fred J. Webbere.*** *SAE Journal*, v. 67, Apr. 1959, p. 80-83.

9410* Examination of the Technological Properties and Internal Stresses in Drawn Free-Cutting Steel Bars. Internal stresses were measured by a turning-off and slitting-up method. Tests results include susceptibility to cracking, swelling, mechanical properties, residual stresses, and internal energy. (*In German.*) Untersuchung der technologischen Eigenschaften und Eigenspannungen gezogener Automatenstähle. ***Alexander Schepers and Arnold Peiter.*** *Stahl und Eisen*, v. 79, no. 6, Mar. 19, 1959, p. 337-349.

9411* Fatigue Strength of Heat Treated Rails Containing Arsenic. The hardening of rail heads in water or oil, when the optimum conditions of the process are maintained carefully, considerably increases the fatigue strength of the rails (this process is not influenced by arsenic if its content in metal does not exceed 0.23%). (*In Russian.*) Ustalostnaia prochnost' termicheski obrabotannykh rel'sov, soderzhashchikh mysh'iak. ***L. L. Pinkhusovich, T. S. Mar'ianovskaia, and Z. G. Fridman.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 360-363.

9412 Mechanical Properties of 17-7 PH and PH 15-7 Mo. Stainless Steel. Tensile, compression and bearing data were obtained on these materials. Tensile stress-strain test results are presented for temperatures ranging from room temperature to 1000 F. A comparison is made between these two steels and AM-350 stainless steel and 6Al-4V titanium strength-weight ratiowise. Strengthwise, the 17-7 PH and PH 15-7 Mo stainless steels are approximately the same to 800 F; above this temperature PH 15-7 Mo is superior. ***Alton W. Brisbane.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-400, Jan. 1959, 31 pp. (TL507 Un3.18w Vis.)

9413 Mechanical Properties of AM350 and AM355 Stainless Steels. Investigation of two stainless steels, AM-350 and Am-355, at several heat treatments and test conditions. Tensile, compression, bearing, bending and Charpy V-notched impact data were obtained. These materials were given several heat treatments to determine the effect on mechanical properties. Varying the aging temperatures had some effect on the strength properties and ductility. The −100 F + 950 F heat treatment gave the best ductility. The sub zero treatment with no elevated temperature aging gives the maximum strength but not the best ductility. ***Alton W. Brisbane.*** *U. S. Air Force. Wright Air Development Center. WADC Technical Report* 58-672, Feb. 1959, 45 pp. (TL507 Un3.18w Vis.)

9414 Elastic Constants of Thorium Single Crystals. Values for the elastic constants c_{11}, c_{12} and c_{44} of Th were determined over the temperature range from 80 to 370 degrees K by ultrasonic measurements on single crystals. Two crystals were prepared by the strain anneal method. One crystal was cut in the form of a circular plate about 0.7 inch in diameter and 0.06 inch thick. The [111] direction of the crystal was perpendicular to the sample face. Measurements on this crystal with a resonance technique produced values for the stiffness coefficient in the [111] direction. ***Philip E. Armstrong and O. N. Carlson.*** *U. S. Atomic Energy Commission, ISC*-993, June 1957, 104 pp. (UF767 Un3.1is Contin.)

See also: **8970** (magnetization reversal in Ni-Fe alloys); **9455** (ductile-brittle transition in Ti); **9486** (magnetic properties of Mn-Co-C alloys); **9781** (fatigue of welded structures).

METALS—MECHANICAL WORKING

9415* How to Machine These HT Alloys. Machining high-temperature alloys. Erratic performance of carbide tools is main difficulty; low speeds, special-purpose cutting fluids, and positive-rake tools are recommended. ***H. M. Schrier.*** *Aircraft and Missiles Manufacturing*, v. 2, May 1959, p. 44-46.

9416 Machinability Testing. Points out the complexity of machining tests, the necessity for systematic and complete planning and recording of tests, and the resulting need for an organized, large-scale attack on an important economic area. ***David N. Smith.*** *ASTE Research Report No.* 8, May 1, 1958, 4 pp. (TJ1186 Am35r Contin.)

9417 The Mechanism of Chip Formation. Theoretical aspects of metal cutting. Mechanism of formation of the chip at the shear plane in terms of the stresses, the geometry, and the relative velocity of the tool-work combination. Dissipation of the input power at the shear plane, at the tool face, and in stored energy in the chip and the workpiece and calculation of temperatures resulting from the energy dissipated. ***Donald Gideon, Ralph Simon, and Horace Grover.*** *ASTE Research Report No.* 9, May 1, 1958, 8 pp. (TJ1186 Am35r Contin.)

9418 Some Thermal and Physical Aspects of Cutting. Analyzes cutting temperatures and the effects of temperature gradients in the shear zone and in the cutting tool. Suggests possible avenues of fruitful research. ***Donald Gideon, Ralph Simon, and Horace Grover.*** *ASTE Research Report No.* 10, May 1, 1958, 7 pp. (TJ1186 Am35r Contin.)

9419 Present Knowledge of Cutting Fluids. Reviews properties of various types of commercial cutting fluids and evaluates the role of cutting fluids in some of the simpler cutting operations. Examines the basic principles and experimental support for the several theories which have been advanced to explain the mechanism of cutting-fluid action. ***Stanley L. Cosgrove and Roy W. Greenlee.*** *ASTE Research Report No.* 11, May 1, 1958, 19 pp. (TJ1186 Am35r Contin.)

9420 Influence of Metallurgical Properties on Metal-Cutting Operations. In a general way, the properties measured in tensile tests explain the machining properties of metals. Strength, ductility, strain-hardening characteristics, and hardness are closely inter-related. They depend on composition and microstructure and can be said to affect machinability. However, tensile data are not directly applicable to the cutting process because temperatures, strain rates, specimen sizes, and stress conditions are entirely different. Machining data are far more useful for evaluating the effects of metallurgical properties on cutting operations. ***Francis W. Boulger.*** *ASTE Research Report No.* 12, May 1, 1958, 19 pp. (TJ1186 Am35r Contin.)

9421 What Is Known Today About Metal Cutting. Summarizes the more widely held opinions concerning tool life, productivity, chip formation, cutting temperatures, cutting fluids, and surface finish. Describes some techniques and pitfalls in experimental procedures. Points out needs for future research. ***Francis W. Boulger.*** *ASTE Research Report No.* 14, May 1, 1958, 9 pp. (TJ1186 Am35r Contin.)

9422* The Cooling Characteristics of Cutting Fluids. Buried thermocouple experiments; ambient temperature rise analysis; surface thermocouple experiments; post shear plane workpiece temperatures; tool life tests. ***M. C. Shaw, N. H. Cook, and P. A. Smith.*** *ASTE Research Report No.* 19, Sept. 15, 1958, 27 pp. + 11 plates. (TJ1186 Am35r Contin.)

9423 An Evaluation of the Present Understanding of Metal Cutting. Surveys chip formation, cutting temperatures, wear and life of single-point tools, cutting fluids, machinability, and experimental and reporting methods. Recommends avenues for further research. ***H. W. Bobel, et al.,*** Battelle Memorial Institute, Columbus, Ohio. *ASTE Research Report No.* 20, Aug. 30, 1958, 275 pp. (TJ1186 Am35r Contin.)

9424 Effect of Deformation of the Surface Texture on Rolling Resistance. Describes the results of a series of experiments showing the variation of the coefficient of rolling resistance, λ, with increasing load for hard steel rollers on a variety of steel surfaces. It was found that the initial value of λ, and the rate of change of λ with increasing load, were both reduced by a series of loading cycles in which the maximum load in any given cycle exceeded the maximum load of the preceding cycle. These changes were also found to be greater for the rougher surfaces. The experimental results are interpreted in terms of the resistance to rolling being dependent on two factors; (a) the hysteresis loss concept, and (b) the requirement for the smooth roller to surmount the irregularities on the surface. ***J. Halling.*** *British Journal of Applied Physics*, v. 10, Apr. 1959, p. 172-176.

9425 Transistorized Programmer Runs 35,000-Ton Press. A transistorized digitally-programmed speed-control system is successfully turning out zero-draft forgings on one of the largest presses in the world. The system changes pressing speed four times in a forging cycle at press platen positions accurate to

1/16 in. in a 6-ft. stroke—on a machine heavy enough to produce 35,000 tons of force. ***Leo Robbins and Anthony L. Liccardi.*** *Control Engineering*, v. 6, May 1959, p. 133-135.

9426 Some Aspects of Explosive-Forming Techniques. Explosive-forming can produce a number of remarkable effects, but the reasons for some of these effects are not known. This article combines the views of three authorities on what is known about the forces at work. ***J. S. Rinehart, V. Philipchuk, and J. Pearson.*** *Engineers' Digest*, v. 20, Apr. 1959, p. 154-155. (From *Steel*, v. 144, no. 3, Jan. 19, 1959, p. 62-65.)

9427* The Forming of Metals by Explosives. A brief discussion of some properties of explosives which may be important in the shaping of metals. ***Julius Roth.*** *Explosives Engineer*, v. 37, no. 2, Mar.-Apr. 1959, p. 52-55.

9428* The Machining of Sintered Hard Carbide Materials by Means of Spark Erosion. I. Development and Underlying Principles of the Spark Erosion Method. After a historical survey of the process, individual components are studied, such as the relaxation circuit and the oscillatory circuit, as well as the theory of spark erosion. The five essential parts of a machine used for the purpose are described. (*In German.*) Die Bearbeitung von harten metallischen Werkstoffen durch die Funkenerosion. I. Entwicklung und Grundlagen der Funkenerosion. ***Friedrich-Wilhelm Neumann and Joachim Wetzger.*** *Frequenz*, v. 13, Jan. 1959, p. 15-21.

9429* High Temperature Mechanical Working of Arc-Cast Molybdenum. ***D. O. Pickman and E. W. Ward.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 116-124.

9430 Explosive Forming Research Active. TNT, nitroglycerine, ammonia gel explosives, and nitrogen methods are being used by aircraft companies. *Light Metal Age*, v. 17, Apr. 1959, p. 16-17.

9431* How to Use Abrasive Cut-Off Wheels Most Efficiently. I. Answers are presented as to what types of cut-off wheels to use for long wheel life, for superior quality of cut, for cutting large areas, small areas, for cutting hard materials, soft materials; also when to use a wide wheel and when to use a thin wheel. ***John A. Mueller.*** *Machine and Tool Blue Book*, v. 54, May 1959, p. 115 + 5 pages.

9432* The Wear of Abrasives in Grinding. Chemical reactions between metal and abrasive, their effect on abrasive wear, and modification by grinding fluids. ***G. J. Goepfert and Josephine L. Williams.*** *Mechanical Engineering*, v. 81, Apr. 1959, p. 69-73.

9433 Designing for Steel Extrusions. A list of some of the metals and alloys which have been successfully extruded is given. If a particular alloy does not appear on this list, it does not necessarily follow that it cannot be extruded. ***J. J. Barrett.*** *Precision Metal Molding*, v. 17, May 1959, p. 68-69.

9434* Conclusions Drawn From Rolling Tests on a Four-Stand Cold Rolling Mill for Broad Strip. Variations of the strip thickness, roll forces and strip tensions in the single stands caused by changing the rolling speed. Theoretical interpretation of the variations in thickness when changing the coefficient of friction, deplacing the roll necks within the backing-up roll bearings, changing the pull and resetting the rolls. Notions as to the repartition of the roll forces among the individual stands. Influence of the layout of the drives on the utilization of the speed of finishing for different rolling schedules. Influence of the slope of the lines for the characteristic electrical data and of the motor load on the automatic compensation of thickness differences in the crude strip. Conclusions as to the possibilities and limitations of influencing upon the final strip thickness in high-speed multiple stand cold strip mills. (*In German.*) Folgerungen aus Versuchswalzungen auf einer viergerüstigen Kalt-Breitbandstrasse. ***Hans Günter Müller and Werner Lueg.*** *Stahl und Eisen*, v. 79, no. 6, Mar. 19, 1959, p. 325-331.

9435* Pointing the Ends of Steel Bars to Be Drawn by Using the Milling or Hot Rolling Method. Methods used in pointing steel bars, their mode of action and peculiarities. Description, efficiency, and costs of installations for pointing. (*In German.*) Anfräsen oder Warmanwalzen der Ziehangeln von Stabstahl. ***Fritz Kottmeier.*** *Stahl und Eisen*, v. 79, no. 6, Mar. 19, 1959, p. 332-337.

9436* Influence of the Behaviour in Transformation of Steels Upon the Tool Wear When Machining the Steels With Tools Made of Cemented Carbide Alloys. Investigations with the electronic microscope and X-rays of the structural changes occurring at the tool face and underside of chip under the following conditions: 15 seconds of turning workpieces made of steels containing 0.10, 0.35, and 0.60% C with a tool of cemented-carbide alloy P 30, as well as turning steel containing about 0.45% C with a tool of cemented-carbide alloy P 10 and P 40. (*In German.*) Einfluss des Umwandlungsverhaltens von Stählen auf den Werkzeugverschleiss bei deren Zerspanung mit Meisseln aus Hartmetallegierungen. ***Herwart Opitz and Günter Ostermann.*** *Stahl und Eisen*, v. 79, no. 8, Apr. 16, 1959, p. 514-522.

9437* The 850/700/500 mm. Continuous Billet Mill. Successful starting of a new continuous billet mill with a number of auxiliary machines of different design, and in particular with high-speed flying shears which do not duplicate the speed of rolling. (*In Russian.*) Nepreryvnyĭ zagotovochnyĭ stan 850/700/500. ***E. A. Zhukevich-Stosha and O. P. Solov'ev.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 336-341.

9438* Inserts of High-Durability for Guides of Rod Mills. When roller guides may not be used in continuous rod mills because this may bring about design troubles, it is expedient in this case to use friction guides with steel inserts, which have boronised working surface and are characterized by their high durability. (*In Russian.*) Vysokostoĭkie vstavki dlia propuskov provolochnykh stanov. ***I. S. Trishevskiĭ, V. V. Klepanda, and A. V. Orlov.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 342-344.

9439* Machines for Separation of Sheets When Rolling Them in Packs. Several types of the roller machines, designed by the Central Designing Bureau of Metallurgical Equipment for mechanical separation of sheets, when rolling them in packs, are used successfully in the industry. This eliminated a number of burdensome manual operations. (*In Russian.*) Mashiny dlia razdeleniia listov pri prokatke paketnym sposobom. ***I. B. Rubinshtein.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 344-347.

9440 General Remarks Relating to the Machine Tool Exhibition Organized at the Leipzig Spring Fair, 1959. Application of the construction box principle to automated machine tools and compound machinery. Automation, continuous operation, and financial economy in connection with different types of roughing and finishing machines. (*In German.*) Grundsätzliches zur Werkzeugmashchinenausstellung auf der Leipziger Frühjahrsmesse 1959. ***K. Gläser.*** *Technik*, 1959, no. 3, p. 133-136.

9441 Tools, Bit Materials and Gripping Tools. Design and operation of multiphase drills, multistage drilling equipment, cutter heads, sintered hard carbide pressure tools for the hot necking of unions on boilers and pipes. Description of the new oxide carbide cutting cermet HC2O. (*In German.*) Werkzeuge, Schneidewerkstoffe und Spannzeuge-Neuentwicklungen. ***H. Martini.*** *Technik*, 1959, no. 3, p. 163-165.

9442 The Grinding Wheel. A Textbook of Modern Grinding Practice. ***Kenneth B. Lewis and W. F. Schleicher.*** Rev. Ed. 527 pp. 1959. The Judson Company, Cleveland, Ohio. (TJ1280 L58g)

9443* A Compound System for Wire Drawing Machines. Describes a system developed by the author's company to cool and clarify wet type wire drawing compounds to draw wire more efficiently. ***A. T. Stoddart.*** *Wire and Wire Products*, v. 34, Apr. 1959, p. 458 + 4 pages.

9444* Measurements of Temperature in Wire Drawing With a Wire Drawing Die Thermocouple Using a Hard Metal Ball Core. ***Rudolph Brühl.*** *Wire and Wire Products*, v. 34, May 1959, p. 573 + 5 pages.

***See also*: 9207** (plastic tooling bibliography); **9327** (cleaning fine wire drawing dies); **9407** (properties of extruded alloys); **9511** (cemented boride cutting tools); **9688** (epoxy resin tools); **9765** (brazing of tip tools).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

9445 Partially Pinned Tilt Boundaries. Presents results of a theoretical study of conditions under which small angle tilt boundaries in a crystal can be moved when subjected to a stress which does not produce general slip. The dislocations in the boundary are assumed to be partially pinned by Cottrell atmospheres, intersecting substructure, or precipitates along the dislocation lines. The results show that partially pinned dislocation boundaries may move at lower stresses than similarly pinned isolated dislocations if the density of pinned segments is sufficiently low. Stress concentrations at pinned segments on a small angle boundary are discussed. A "yield condition" for motion of certain partially pinned boundaries is described in which pinned dislocations are left behind when the boundary is moved. ***T. Vreeland, Jr.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 240-245.

9446 Mechanical Properties of Iron and Some Iron Alloys While Undergoing Allotropic Transformation. When transforming pure coarse grained iron in a steep gradient of temperature along the axis of the specimen, the maximum change of length for zero external stress is $\Delta V/V$. For the $\gamma \rightarrow \alpha$ transformation no influence of stress on the maximum change of length is observed. The results are discussed by assuming a tendency for the mean macroscopic dilatation to be zero along the phase boundary, as in the case of diffusionless transformations. ***M. De Jong and G. W. Rathenau.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 246-253.

9447 The Growth of Temper Carbon Nodules. The equations relating the radius of a temper carbon nodule to the time of annealing during first stage graphitization are presented for each of the possible controlling mechanisms, and compared with experimental growth curves. The relation between these equations and that giving the fraction graphitization as a function of time is discussed. From these considerations it is concluded that, in the alloys considered, the rate of solution of cementite determines the rate of growth of graphite, except during the very early stages of the reaction. ***J. Burke.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 268-274.

9448 Aging in Au-Ni Alloys. Measurements were made of changes in some physical properties of quenched alloys of 70% Au-30% Ni when they were annealed at low temperatures. Changes in the electrical resistance, volume, and Young's modulus were observed to occur. They indicate that there is at least one metastable precipitate formed on low temperature annealing; it occurs about 10^4 times earlier than the main phase change. ***J. Sivertsen and C. Wert.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 275-282.

9449 The Orientation Dependence of Etching Effects on Germanium Crystals. There is a marked variation with crystal orientation of the many well-known etchants for Ge. For example, some etchants (like CP-4) only form etch pits at dislocation sites when the surface is within a few degrees of (111) or (100). The detailed results of etching are dependent, in many cases, on the exact conditions of attack (temperature, impurity content of the semiconductor, etch composition, and illumination). A convenient way of studying these effects is by treating small polished hemispheres of single-crystal Ge, and examining the results as a function of their position on the crystal. ***P. J. Holmes.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 283-290.

9450 On the Structure Changes Produced by Ageing of Cu-Ti Alloy. Structure changes were studied microscopically on Cu-3% Ti alloys, which were solution-treated and aged at 550 to 700 C. Observations on cellular precipitation were made for the specimens aged between 550 and 600 C. The precipitates started to grow at the grain boundaries, and spread gradually into the matrix. ***Toshio Doi.*** *Acta Metallurgica*, v. 7, Apr. 1959, p. 291-292.

9451* The Thermodynamics of the Liquidus-Solidus Gap in Binary Alloys. The Silver-Gold System. System was investigated by thermal analysis to resolve the discrepancy between the phase diagram and the measured thermodynamic properties of the solid and liquid alloys. The results confirm the gap calculated from the thermodynamic properties. A method for the calculation of $\Delta(\Delta F)$ from precise measurements of the liquidus-solidus gap is presented and applied to the experimental results. $\Delta(\Delta F)$ is small for Ag-Au alloys, indicating a misfit energy near zero and a close similarity between the thermodynamic properties of the solid and liquid alloys. ***J. L. White.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 178-181.

9452* The Activities of Iron and Nickel in Liquid Fe-Ni Alloys. Activities determined by measuring the vapor pressures of Fe and Ni above the alloys and comparing with the vapor pressures of the pure metals. Nickel was found to deviate negatively from Raoult's law over the entire composition range. Iron behaves ideally down to 0.7 mole fraction but shows negative deviations at lower concentrations. At 1600 C the activity coefficients at infinite dilution are 0.40 for Fe and 0.66 for Ni. ***G. R. Zellars, S. L. Payne, J. P. Morris, and R. L. Kipp.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 181-185.

9453* Activities of Iron and Nickel in Liquid Iron-Nickel Solutions. Activities in solutions containing from 10 to 90 at. % Ni were measured over the temperature range 1510 to 1600 C. A special function was devised whereby activities can be computed by a graphical integration using the results of chemical analyses on the vapor phase alone. The liquid solutions studied exhibit negative deviation from Raoult's law, but they approach ideality as the temperature is raised from 1510 to 1600 C. The maximum heat of solution is less than -8.0 kcal per mole. The entropy of solution is less than -2.5 kcal per mole deg. at 1510 C. and changes negligibly as the temperature is raised. ***R. Speiser, A. J. Jacobs, and J. W. Spretnak.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 185-192.

9454* The Antimony-Uranium Alloy System. Investigated by metallographic, thermal, and X-ray methods. There are four intermediate phases present: USb_2 and U_3Sb_4 which undergo peritectic decomposition at 1335 and 1695 C. respectively, and USb and U_4Sb_3 which melt congruently at 1850 and 1800 C. respectively. There is a eutectic between U_4Sb_3 and USb which melts at 1770 C. USb_2, U_3Sb_4, and USb are line compounds while U_4Sb_3 has a solubility range of approximately 1.5 at. % at 1770 C. The solubility of U in liquid Sb increases from 0.1 at. % at 650 C to 1.5 at. % at 900 C. The solubility of Sb in α, β, and γ U is approximately 0.02, 0.1, and 0.05 at. % respectively. ***R. J. Beaudry and A. H. Daane.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 199-203.

9455* The Dislocation-Oxygen Interaction in Alpha Titanium and Its Effect on the Ductile-to-Brittle Transition. Internal friction techniques using a low-frequency torsion pendulum were used to study the O atom interactions with dislocations in "superpurity" Ti. Both the saturation of the room temperature decrement and the transition from ductile to brittle behavior occurred at 1.5 at. % O. It was proposed that the embrittlement was due to O atoms immobilizing the dislocations. It was possible to increase the ductility of the Ti-O binary alloys by decreasing the O pinning. ***D. Gupta and S. Weinig.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 209-216.

9456* A Search for the Sigma Phase in the Fe-W and Co-W Alloy Systems. Sigma phase was found in both systems. The peritectic temperature of 1640 C in the Fe-W system appears questionable according to this data. ***E. C. van Reuth.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 2, Apr. 1959, p. 216-218.

9457* The Free-Energy Changes Attending the Martensitic Transformation in the Iron-Chromium and Iron-Chromium-Nickel Systems. An equation is derived relating the difference in free energy between austenite and martensite, to temperature and composition in the Fe-Cr and Fe-Cr-Ni systems. A method for utilizing the energetic equations to calculate M_s in

stainless steels is suggested. In addition, an explanation is given for the anomalous effect of Cr in forming a γ loop concurrent with the lowering of M_s in Fe-base alloys. ***Larry Kaufman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 218-223.

9458* Dislocation Blocking in Face-Centered-Cubic Metals. A delay time for yielding in cold-worked face-centered-cubic metals was found. Slip on { 123 } planes was observed. Glide on these planes occurred during the delay-time period before slip starts on the { 111 } planes. ***I. R. Kramer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 226-230.

9459* The Irradiation Stability of Low Wt Pct Uranium-Zirconium Alloys. The results of an exploratory study conducted by personnel of the Knolls Atomic Power Laboratory on 18.6, 22, and 40 wt. % U-Zr alloy are presented. ***A. H. Willis.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 245-251.

9460* On the Nickel-Rich End of the Zirconium-Nickel Phase Diagram. Explores in detail the Zr-Ni system from 0 to 25 at. % Zr. ***D. Kramer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 256-258.

9461* X-Ray Detection of Dislocation Tilts and Strains in Single Crystals of Copper. A general treatment of the broadening of X-ray double-crystal spectrometer rocking curves due to distributions of tilts and strains. Results were applied to the case where dislocations in a crystal give rise to both tilts and strains. Experimental determination of the β_c - Θ curves for a series of Cu single crystals prepared by the Bridgeman and Czochralski methods yields results in agreement with the calculated slope-intercept ratio for a Cauchy distribution of dislocations. ***Larry Kaufman and S. Andrew Kulin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 273-279.

9462* Diffusion of Zinc From the Vapor Phase Into Copper-Zinc and Silver-Zinc Alloys. Zinc vapor from a reservoir of liquid Zn maintained at lower temperatures was diffused into sets of Cu-Zn alloys at 759 and 870 C and into sets of Ag-Zn alloys at 650 and 700 C. Each set of four Cu-Zn alloys consisted of pure Cu and 90/10, 80/20, and 70/30 brass. Similarly, the set of Ag-base alloys consisted of specimens containing 0, 7, 15, and 20% Zn. Natural markers at the initial surfaces of the specimens were "trapped" under a thin electroplate and their depth of burying was measured after diffusion. ***A. G. Guy.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 279-282.

9463* CsCl-Type Equiatomic Phases in Binary Alloys of Transition Elements. Lattice parameters were determined for 18 equiatomic alloys of the CsCl-type structure. It was found that formation of the CsCl-type structure in binary alloys of the transition elements is largely dependent on position of the elements in the periodic table. The relative size of the two elements was not found to be a controlling factor. ***A. E. Dwight.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 283-286.

9464* Orientation Sensitivity of Alpha Titanium to Electrostaining. Large-grain specimens of iodide Ti prepared metallographically were stain etched, using the technique of New York University as modified by Watertown Arsenal Laboratories. Orientations of grains showing an abnormal response to stain etching were determined by back-reflection X-ray techniques. X-ray results showed that α-Ti grains, oriented such that their basal planes were parallel to the polished surface, have a slower reactivity to stain etching than any other orientation. Grains oriented such that their basal planes made small angles with the polished surface exhibited reaction rates between that of the true basal orientation and the normal rate. These data, plus work on polycrystalline specimens, indicate that the oxidation rate of Ti might be reduced by correct alignment of crystal planes. ***R. H. Hiltz and R. W. Douglass.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 286-289.

9465* Retrogression in Age Hardening. An Al-4% Cu alloy aged at room temperature for times increasing up to 78,000 hr. was annealed at 170 C and the hardness and electrolytic potential determined during retrogression and subsequent aging. It was found that there is a change of behavior with increasing time of aging at room temperature which indicates that, given sufficient time, retrogression disappears and the room-temperature aging tends to progress directly into the high-temperature aging. ***L. F. Mondolfo.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 289-294.

9466* Solubility of Oxygen in Alpha Iron: A Revision. Upon repeating O saturation experiments with zone-refined Fe, it was found that the O solid solubility was at least an order of magnitude less than previously observed. ***A. U. Seybolt.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 298-301.

9467* A Study of the Peritectoid Transformation. Six examples were selected from the literature and studied by the method of isothermal transformation. The kinetics and mechanisms of five of the examples are presented as TTT diagrams and photomicrographs. The existence of a peritectoid in the sixth case is doubtful. ***R. D. Reiswig and D. J. Mack.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 301-307.

9468* Observations on the Recrystallization of a Silicon-Iron Crystal in a Polygonized Matrix. Observations were made on the recrystallization of a 70% cold-rolled Si-Fe crystal with an initial orientation of (113) $[\bar{3}\bar{3}2]$. Its polygonization and recrystallization characteristics were studied. Results indicated that recrystallization tendency of the deformed crystal is much weakened by the polygonization of the matrix. Complete recrystallization in such specimens is achieved by the growth of recrystallized grains of sufficient size and of the right orientations in relation to the matrix. ***Hsun Hu.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 320-326.

9469* The Immiscibility Limits of Uranium With the Rare-Earth Metals. The limits of miscibility in some of the U rare-earth alloy systems were determined in the temperature range 1000 to 1250 C. The solubilities of La and Ce in U are greater than those of the remaining rare earths by a factor of more than two. The solubility of U is greater in Ce, Pr, and Nd than in the other rare-earth metals studied. ***J. F. Haefling and A. H. Daane.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 336-338.

9470 The Ageing of Steel. Aging in general, indicates a tendency towards attaining equilibrium following disturbances caused by quick cooling or cold-working. Quench-aging; strain-aging; strain-aging and yield point: dislocation theory. ***B. R. Nijhawan.*** *Blast Furnace and Steel Plant,* v. 47, May 1959, p. 485-489.

9471 Dendritic Crystallization. ***D. D. Saratovkin.*** 2nd Ed. 126 pp. 1959. Consultants Bureau, Inc., New York. (TN690 Sa71d2tr)

9472 Determination of Crystal Orientation by High Intensity Reflectograms. An instrument based on the light figure technique for optical orientation of Ge and Si is described which fulfills all requirements for a fast precision orientation of single crystals. The dependence of high intensity reflectograms on etching conditions is shown and standard etching specifications are given. ***G. H. Schwuttke.*** *Electrochemical Society, Journal,* v. 106, Apr. 1959, p. 315-317.

9473 Elements of Physical Metallurgy. The new edition includes introduction of dislocation theory, more on electron theory of metals to cover electric phenomena in semiconductors,

and introduction of a new chapter, *Phases in Metal Systems*. ***Albert G. Guy.*** 2nd Ed. 528 pp. 1959. Addison-Wesley Publishing Company, Inc., Reading, Massachusetts. (TN690 G98e2)

9474* Investigation of Diffusion in the Chromium-Nitrogen System. The diffusion begins with marked speed at 700 C and is subjected to a parabolical temporary law in each temperature interval up to 1200 C. With increase of temperature the rate of diffusion increases slowly at first (below 1030 C), then rapidly (above 1030 C). A Cr_2N layer is formed. (*In Russian.*) Issledovanie diffuzii v sisteme khrom-azot. ***V. I. Arkharov, V. N. Konev, and A. Z. Men'shikov.*** *Fizika Metallov i Metallovedenie*, v. 7, no. 1, Jan. 1959, p. 64-71.

9475 Etch Patterns in Zinc. Loops and spiral etch patterns were observed on surfaces parallel, or nearly parallel, to the basal plan of zinc. Their motion and growth were recorded and appeared similar to the mechanism proposed by Frank and Read for the generation of dislocations. These observations have been tentatively interpreted as the dissolution of a step in the surface with the ends of the steps pinned. ***Victor V. Damiano and Marvin Herman.*** *Franklin Institute, Journal*, v. 267, no. 4, Apr. 1959, p. 303-315.

9476* Graphitization in Cast Iron-Carbon Alloys. Graphitization in various forms of Fe-C materials. Characteristic forms of graphites; shape and location of the graphite in the mixed crystal; classification in five graphite types; formation of graphite through the disintegration of ledeburite; establishment of an all-embracing pattern of the mechanism of graphite formation. (*In German.*) Graphitbildung in Eisen-Kohlenstoff-Gusslegierungen. ***Adalbert Wittmoser.*** *Giesserei*, v. 46, no. 8, Apr. 9, 1959, p. 177-187.

9477* Methods of Metallographic Examination of Uranium Structure. Electrolytic polishing and etching of U. Determination of the most suitable current conditions and electrolytes. Importance of contrast distinction of different grains during electrolytic etching of U. Effect of heat treatment on etching. (*In Czech.*) Metody metalografického vyšetřování struktury uranu. ***B. Přenosil and J. Vobořil.*** *Hutnické Listy*, v. 14, no. 4, Apr. 1959, p. 309-315.

9478 An Investigation of Hydrogen Embrittlement in Copper. The deoxidation and the H embrittlement of O-bearing Cu were investigated by means of annealing experiments in the range 400-700 C. The effects of H pressure, annealing temperature, and annealing time were studied. ***Einar Mattsson and Franz Schückher.*** *Institute of Metals, Journal*, v. 87, pt. 8, Apr. 1959, p. 241-247.

9479 A Segregation Substructure in Aluminium. A fine (approximately 1μ) structure observed on the surface of chemically polished Al was investigated. On the basis of various observations of the surface in both the annealed and deformed conditions, the structure is concluded to be a surface manifestation of an underlying three-dimensional network. A physical model for the existence of these structures is proposed which is based on the segregation of impurity atoms. ***Frank B. Cuff, Jr. and Nicholas J. Grant.*** *Institute of Metals, Journal*, v. 87, pt. 8, Apr. 1959, p. 248-254.

9480 Recrystallization of Lead During Creep. Extruded specimens of high-purity, commercial, and electrolytic lead, hydrogen reduced and vacuum cast, were annealed and tested at stresses of 300-500 lb/in.^{2} at room temperature under direct loading. The dependence of R, the creep strain at which recrystallization begins upon various conditions, was studied. The acceleration of creep associated with recrystallization is shown to result from primary creep of the new grains and not from the actual process of recrystallization. Although recrystallization appeared to consist of nucleation and growth, its characteristics were predominantly those of marked grain growth. It is suggested that the nuclei form near the grain boundaries to which impurities, especially O, segregate during annealing. These and previous observations are discussed in relation to a general mechanism. ***R. C. Gifkins.*** *Institute of Metals, Journal*, v. 87, pt. 8, Apr. 1959, p. 255-261.

9481 The Effect of Specimen Size on the Quench-Ageing of an Aluminium-3.8% Copper Alloy. Massive specimens show a much lower hardening rate during the first stage of quench-aging than do thin specimens. Experiments are described which lead to the conclusion that the failure to retain vacancies in the larger specimens is the cause of the low hardening rate. ***Ved Prakash and K. M. Entwistle.*** *Institute of Metals, Journal*, v. 87, pt. 8, Apr. 1959, p. 262-264.

9482 The Constitution of Molybdenum-Rhodium and Molybdenum-Palladium Alloys. Two laboratory furnaces are described in which specimens weighing 1-5 g. can be heated *in vacuo* or in an Ar atmosphere at temperatures up to 2700 C, and then quenched into a Cu mold or into silicone oil. These were used to measure the melting points of Rh, Cr, Ir, and Mo, and also to determine the equilibrium diagrams of Mo-rich alloys in the systems Mo-Rh and Mo-Pd, the liquidus curves for which were determined by the quenching method. ***C. W. Haworth and W. Hume-Rothery.*** *Institute of Metals, Journal*, v. 87, pt. 8, Apr. 1959, p. 265-272.

9483 The Effect of Austenitizing Treatment on Formation of Lower Bainite in a Plain Carbon Steel. The effects of solution-treatment temperature and time on the kinetics of the formation of lower bainite were studied metallographically and dilatometrically for a 0.97% plain carbon steel. For macroscopically homogeneous specimens of austenite, the early stages of transformation are accelerated when the austenite grain size is increased, although the time for complete transformation is insensitive to grain size. For homogeneous austenite of constant grain size, the transformation characteristics are found to vary with austenitizing temperature in a thermally reversible manner: increasing the austenitizing temperature slows down the transformation and increases the volume change which accompanies it. ***L. W. Graham and H. J. Axon.*** *Iron and Steel Institute, Journal*, v. 191, pt. 4, Apr. 1959, p. 361-365.

9484* The Influence of Annealing on the Pearlite Structure of a Eutectoid Carbon Steel. Fine and coarse pearlite formed at 650 and 700 C, respectively, was annealed at 650 and 700 C for different lengths of time. Hardness and microstructure (light and electron microscope) were investigated. ***Helfrid Modin.*** *Jernkontorets Annaler*, v. 143, no. 2, 1959, p. 76-116.

9485 Internal Structure of Cross-Tie Walls in Thin Permalloy Films Through High-Resolution Bitter Techniques. The use of a water immersion objective with the optical microscope for Bitter pattern studies resulted in a significant improvement in resolution. Applied to the study of cross-tie domain walls in thin Permalloy films, this technique revealed details of internal wall structure. In the proposed model for such walls the magnetization within the wall is thought to be predominantly in the plane of the film, with periodic transition regions in which the magnetization is normal to the film. In support of the model, convincing evidence is presented of the reported shift of colloid particles when an external field is applied normal to the film. ***Ralph M. Moon.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 82S-83S.

9486 Structural and Magnetic Properties of Mn-Co-C Alloys. $Mn_xCo(80\text{-}x)C_{20}$ alloys were studied for magnetic properties, crystal structure, and metallographic appearance. A superkattice having the stoichiometric composition Mn_2Co_5C was found to be markedly magnetic. The structure of this alloy is pseudo-f.c.c. with the C atom in the central $\frac{111}{222}$ position, the Mn atoms in the 000 and $\frac{11}{22}0$ sites, and the Co atoms in the $0\frac{11}{22}$ and $\frac{1}{2}0\frac{1}{2}$ sites. A magnetic structure was deduced from a consideration of the effect of atomic separation on magnetic vector alignment and an indication that electrons transfer from the central C atom to its nearest neighbors, the face atoms. ***A. H. Holtzman and G. P. Conrad, II.*** *Journal of Applied Physics*, (Supplement), v. 30, Apr. 1959, p. 103S-104S.

9487 Precipitation in a Beta-Brass-Fe Alloy. Single crystal samples of beta-brass containing 0.1% Fe were annealed at 300 and 400 C in order to develop the Fe precipitate particles. At intervals during the anneals, magnetic data were obtained and analyzed in terms of the size, shape, orientation, and general magnetic behavior of the precipitate particles. ***A. E. Berkowitz and P. J. Flanders.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 111S-112S.

9488 Metallurgical Considerations. Development of Metallurgical Structures and Magnetic Properties in Iron Silicon Alloys. A brief history of the development of Si-Fe alloys is given. The processes which lead to the development of strong textures of both the cube and cube-on-edge type are then reviewed and a comparison of some of the magnetic properties of textured Si-Fe is presented. It is concluded that major technological and scientific opportunities still lie in the understanding of mechanism of texture development. ***R. H. Pry.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 189S-193S.

9489 Nucleation of Ferromagnetic Domains in Iron Whiskers. Nucleation fields up to 483 oe were experimentally observed for the reversal of magnetization in regions of nearly perfect whiskers about 5μ thick. This is near the theoretical limit $2K_1/M_s$ (=560 oe for Fe) for the coercive force resulting from magnetocrystalline anisotropy. In addition, conspicuous growth defects on the surface are observed to be sites of easy nucleation. A field of about one oersted, if applied to the damaged end of a whisker of this size, suffices to reverse the magnetization by domain wall motion. ***R. W. DeBlois and C. P. Bean.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 225S-226S.

9490 Enhanced Diffusion. Report on the Conference on Enhanced Diffusion, held at the University of Pennsylvania on Oct. 1, 1958. Although some discrepancies still exist, the salient experimental features for enhancing diffusion have been established. One feature which is rather obscure at this point is the role of defects other than vacancies. One cannot differentiate between these defects on the basis of the irradiation experiments that have been done to date. There is some hope that conditions can be modified to yield the required pertinent information. In the case of the plastic deformation experiments, a full quantitative interpretation of the data is required before the role of the two primary point defects is clarified. ***G. J. Dienes.*** *Journal of Metals*, v. 11, Apr. 1959, p. 281.

9491* Factors Affecting the Grain Structure of As-Cast Molybdenum Ingots. For many years the production of sound castings of the commoner metals by conventional methods has been largely a matter of trial and error. In contrast, the vacuum and the inert-gas arc-melting processes are only about ten years old and the metals melted are usually the less commoner ones and are fairly expensive. In consequence, melting techniques are being developed on a scientific and experimental basis. Although this paper deals principally with Mo ingots produced by the cold-mound consumable-electrode arc-melting process, some of the principles of the results given should also be applicable to other metals. ***A. R. Moss.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 34-41.

9492* An Examination of Part of the Titanium-Carbon System. Titanium-carbon alloys have aroused interest because of the beneficial effect of carbon on the Young's modulus of Ti. As part of a study of alloys of this system, the liquidus at the Ti-rich end of the phase diagram was studied up to 1763 C. ***R. L. Bickerdike and G. Hughes.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 42-49.

9493* A Molybdenum Resistance Cooling Curve Furnace. A considerable difficulty is presented in fundamental research on solidification by the interpretation of cooling curves. An attempt has been made to overcome this difficulty by constructing a cooling curve furnace which gives an approximately uniform rate of loss or gain of heat over small temperature ranges. ***W. Oldfield.*** *Journal of the Less-Common Metals*, v. 1, no. 1, Feb. 1959, p. 77-79.

9494* The Structure of Beryllium, With Particular Reference to Temperatures Above 1200°C. Heating and cooling curves were produced for Be specimens of varying impurity content, including commercial purity metal, the pure and impure portions of a zone refined bar, and the condensate and residue from a vacuum distillation process. No evidence of a solid-state change between 25 and 1200 C was detected in any experiment. A study of the traces above 1200 C, however, revealed the double thermal arrest in the region of the melting point which has been described by other workers. ***A. J. Martin and A. Moore.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 85-93.

9495* Solid State Transitions in Manganese and Iron Solid Solutions. The form of the equilibrium diagrams for binary alloys of metals in the B sub-groups of the periodic table can be related to electron:atom ratios, regarding the component metals as exhibiting their "group valency". This relation, together with the consideration of relative atomic radii, enables one to understand the general form of the alloy diagrams, and has received considerable theoretical justification. ***A. Hellawell.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 110-112.

9496* The Equilibrium Diagram of the System Bismuth-Palladium. Studies in the region 0 to 65 at. % Pd by thermal analysis and microscopic methods. ***J. Brasier and W. Hume-Rothery.*** *Journal of the Less-Common Metals*, v. 1, no. 2, Apr. 1959, p. 157-164.

9497* The Growth of Metal Single Crystals. Survey of methods available. Growth from a melt and in the solid state. Growth of alloy crystals. Imperfections in single crystals. A table of the most suitable method of growing single crystals of a number of the principal metals is given. ***R. W. K. Honeycombe.*** *Metallurgical Reviews*, v. 4, no. 13, 1959, p. 1-47 + 6 plates.

9498* An Experimental Investigation on the Mode of Slip in Face-Centered Cubic Metals. The changes of saturation magnetization of the order Ni_3Mn and Pt_3Co alloys caused by plastic deformation were used as the criterion to decide whether the slip in metals is "homogeneous" or "inhomogeneous", i.e., whether it takes place in atomic steps on many successive atomic planes or in large steps on widely separated single atomic planes. It was found that in the ordered Ni_3Mn alloy, the saturation magnetization decreases with the amount of elongation at room temperature, while in the ordered Pt_3Co alloy, the intensity of magnetization in temperature near the Curie point increases with the amount of compression. These changes, which are roughly proportional to the amount of deformation, probably are understood only from the point of view that a new disordered phase with Curie point different from that of the ordered state is produced during the deformation, being associated with homogeneous slip on successive atomic planes. ***Tadami Taoka, Kō Yasukōchi, Ryukichi Honda, and Isao Oyama.*** *National Research Institute for Metals, Transactions*, v. 1, no. 1, 1959, p. 1-6.

9499* On the Superstructure of the Ordered Alloy Cu_3Pd. III. High Temperature Electron Diffraction Study. Using a high temperature electron diffraction camera, Cu_3Pd alloys were investigated in thin oriented, evaporated films at temperatures below and above the critical point of order-disorder. ***Denjiro Watanabe.*** *Physical Society of Japan, Journal*, v. 14, Apr. 1959, p. 436-443.

9500* Electron Diffraction Study on Polish Layers of Gold, II. Polish layer of gold was examined by means of the transmission method of electron diffraction. The diffraction pattern from the highly polished layer of gold (the Beilby layer) consists of three haloes. ***Masao Kuriyama.*** *Physical Society of Japan, Journal*, v. 14, Apr. 1959, p. 487-492.

9501* A Modification of Prager's Hardening Rule. The rule of isotropic work-hardening does not account for the Bauschinger effect observed in the materials in question. Prager's hardening rule accounts for this effect. ***Hans Ziegler.*** *Quarterly of Applied Mathematics*, v. 17, no. 1, Apr. 1959, p. 55-65.

9502 Reactions in the Niobium-Hydrogen System. Equilibria in the Nb-H system were determined in the range 100 to 900 C, H pressure of 0.1 to 1000 mm of Hg, and H-Nb atomic ratios of 0.01 to 0.85. X-ray measurements were obtained at 25 to 400 C at H-Nb ratios up to 0.54. The studies

showed that a solid solution of H in Nb is produced throughout most of the system. A miscibility gap was found at low temperatures and pressures, with a critical point at about a temperature of 140 C, a H pressure of 0.01 mm of Hg, and a H-Nb ratio of 0.3. Sorption rates at 300 to 550 C were initially linear. ***William M. Albrecht, W. Douglas Goode, Jr., and Manley W. Mallett.*** *U. S. Atomic Energy Commission, BMI-1332,* April 1, 1959, 20 pp. (UF767 U3b Contin.)

9503 The Precision Determination of Lattice Constants by the Asymmetric Method. Historical survey; powder patterns by the asymmetric method; the rotating crystal method for precision determinations. ***M. E. Straumanis and A. Ievins.*** *U. S. Atomic Energy Commission, GAT-T-643,* Apr. 15, 1959, 51 pp. (UF767 Un3.1ga Contin.)

9504 Habit Plane for Hydride Precipitation in Zirconium and Uranium-Zirconium. The distribtuion of H, in the 100-ppm range, was found to be of platelet form for Zr and 1 wt% U-Zr single crystals. The habit planes for the hydride platelets in the Zr crystals were found to be $(11\bar{2}2)$, $(10\bar{1}2)$, and $(11\bar{2}1)$ while the habit planes in the 1 wt% U-Zr crystals were of the $(12\bar{3}1)$, $(11\bar{2}1)$, and $(11\bar{2}3)$ types. With the exception of the $(12\bar{3}1)$ plane, these have been identified as the twin planes in Zr. The effect of H on the high and low strain-rate mechanical properties of Zr is explained with reference to the findings of this investigation. ***F. W. Kunz and A. E. Bibb.*** *U. S. Atomic Energy Commission, KAPL-2002,* Jan. 22, 1959, 7 pp. (UF767 Un3.1ka Contin.)

9505 The Etching of Plutonium and Its Alloys by Cathodic Bombardment. The development of microstructural detail by cathodic bombardment has been used successfully for many metals and alloys which are difficult to etch by conventional methods. An application of this technique to Pu and its alloys is presented here. A method for preventing the specimen from overheating is included in the description of the equipment. ***Katherine Imlah.*** *U. S. Atomic Energy Commission, LA-2287,* Jan. 6, 1959, 43 pp. (UF767 U3La Contin.)

9506 Hydrogen Redistribution in Zircaloy-2 Under Thermal and Mechanical Stress Gradients. Past and current work on the study of the movement of dissolved H in Zircaloy-2 under the influence of thermal, mechanical stress and two-phase activity gradients is reviewed, and the findings are discussed. A program of future work is presented. Discusses thermal diffusion, stress gradient diffusion, activity gradient studies, effect of stress, and thermal conductivity. ***J. M. Markowitz.*** *U. S. Atomic Energy Commission, WAPD-TM-171,* Jan. 1959, 17 pp. (UF767 Un3.1wa Contin.)

9507* Carbide Phases of Niobium. The binary system Nb-NbC was reexamined, and α, β, ζ and σ phases were found between 1800 C and 2000 C. Regions of existence and the structure of the phases were determined. Samples with very high carbide content proved thermally instable; part of the C is precipitated after heat treatment. The lattice parameter for the relatively stable $NbC_{0.91}$, the carbide with the highest C content, was determined as 4.4690 A. (*In German.*) Karbidphasen des Niobs. ***Georg Brauer und Richard Lesser.*** *Zeitschrift für Metallkunde,* v. 50, Jan. 1959, p. 8-10.

9508* Ternary Carbides of the T-Metals Nickel, Cobalt, Iron and Maganese With Germanium and Indium. In the ternary systems Co-Ge-C, Fe-Ge-C, Mn-Ge-C, Ni-In-C, Co-In-C, and Fe-In-C, double carbides were found that correspond to the formula T_3BC_2 where T is the transition metal. Together with the known carbide Mn_3InC, these compounds belong to a separate group of carbides which have in common an ordered face-centered cubic structure. The electronic nature of these compounds is discussed. (*In German.*) Über ternäre Karbide der T-Metalle Nickel, Kobalt, Eisen und Mangan mit Germanium und Indium. ***Leo J. Hütter und Hans H. Stadelmaier.*** *Zeitschrift für Metallkunde,* v. 50, Apr. 1959, p. 199-203.

See also: **9235** (austenitizing behavior of bearing steel); **9389** (effect of ordering on magnetic properties); **9400** (effect of neutron irradiation on ordering of magnetic alloys); **9406** (order-disorder in Ni_3Fe).

METALS—POWDER

9509* The Effect of Compressive Stresses on Shrinkage in the Sintering of Porous Bodies. Results are presented of a study of the effect of uneven compressive stresses on volume shrinkage of sintered bodies consisting of Ag, Cu, and Ni powders (T = 600-800 C, t = 5 minutes). The dependence of shrinkage on stress, allowing for the geometrical factor, proved to be nonlinear in the case of annealed powders, which is due to plastic deformation arising on application of load. The inference may be drawn that, under conditions of "free" sintering, the processes occurring are diffusion processes and not plastic strain. (*In Ukrainian.*) Pro vplyv styskuiuchykh napruzhen' na usadku pry spikanni porystykh til. ***I. M. Fedorchenko and R. O. Andriyevs'kyi.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi,* 1959, no. 3, p. 281-285.

9510* Nonmetallic Dispersions in Cobalt. The effect of oxide dispersions on mechanical properties of Co and Co-base powder-metallurgy alloys was investigated. This study shows that oxide dispersions added to pure Co greatly improve the high-temperature creep resistance of the metal. Dispersions in Co alloys were much less effective. ***E. F. Adkins, C. T. Sims, and R. I. Jaffee.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 2, Apr. 1959, p. 344-352.

9511 Cemented Borides for Tool Materials. Development of a material based on borides suitable for replacing cemented carbides in the event of restricted supplies of W. Determination of the suitability of cemented borides as tool materials. The principal problem associated with the development of cemented borides is the readiness with which the bond metal reacts with the borides. ***A. G. Metcalfe.*** *ASTE Research Report No.* 2, Mar. 19, 1956, 11 pp. (TJ1186 Am35r Contin.)

9512* The Pressing of Brittle Powders. A mathematical approach to pressing, and a study of the differences in the process when applied to brittle or to plastic powders. Change in the sinter density as a function of different non-metallic additions. (*In Polish.*) Prasowanie proszków kruchych. ***Władysław Rutkowski.*** *Hutnik,* v. 25, no. 10, Oct. 1958, p. 397-402.

9513 Dispersion Strengthened Alloys: Properties and Applications of Light Metals. Aluminum and Mg alloys have culminated in the dispersion-strengthened type of materials which excel in their thermal stability at temperatures above those endurable by conventional alloys. Actual and potential applications for these alloys exist in aircraft, automotive, and chemical equipment. Beryllium produced from metal powder displays a better combination of ductility and strength than that obtained by fusion metallurgy. It is of interest as construction material for nuclear reactor components, and also has potential uses in airborne vehicles. ***Claus G. Goetzel.*** *Journal of Metals,* v. 11, Apr. 1959, p. 276-280.

9514* Elastic Deformation of Metal Powder During Pressing. It was found that the change in dimension caused by elastic deformation and other phenomena, varies definitely with the pressing pressure. It also depends on the grain size of the powder; if this is reduced the dimension increases considerably after relaxation of pressure. (*In German.*) Zur elastischen Verformung der Metallpulver während des Pressens. ***W. Rutkowski.*** *Neue Hütte,* v. 4, Feb. 1959, p. 110-113.

9515 For Many Thin Parts . . . Powder Metallurgy *Can* Compete With Stamping. Unless strength obtainable with alloy steel is necessary—in combination with a high degree of ductility—metal-powder may offer a number of advantages. Stainless steel and other higher alloy powders now provide high physical properties in metal-powder parts, as do special treatments—such as coining after sintering, infiltration. The point is—simple pressed and sintered parts can be as cheap or cheaper than stampings. ***John Haller.*** *Product Engineering* (Design Digest Issue), v. 30, no. 19, May 11, 1959, p. 82-83.

9516 An Investigation of the Mechanical Properties of Cermets as Related to the Microstructure. Using 60 TiC-40 Ni as the test material, seven different test groups were formulated, comprising changes in original particle size, processing procedure, and controlled binder addition. Each test

group was heated in seven different fashions. In general, a fine-grain size corresponds to a higher-strength sample, especially if this fine-grained structure does not contain many grains of much-larger-than-average size. However, a generally fine-grained structure, with the grains agglomerated in large clusters, with lots of porosity in between, does not correspond to a high strength. Small amounts of impurities may have disproportionate effects on properties. ***Ira Binder and Robert Steinitz.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-432, Jan. 1959, 86 pp. (TL507 Un3.18w Vis.)

9517 Corrosion Resistance and Mechanical Properties of Aluminum Powder Products. Experimental extrusions were prepared from mixtures of atomized Al alloy and several powdered additives, including SiO_2, $AlPO_4$ and Al_2O_3. Some of the extrusions failed during corrosion testing in water at 290 and 350 C; others corroded in approximately the same fashion as wrought X8001 alloy. The ultimate tensile strengths of these extrusions at 316 C were approximately two and one-half times greater than that of wrought X8001 alloy. ***J. E. Draley and W. E. Ruther.*** *U. S. Atomic Energy Commission, ANL*-5927, Mar. 1959, 10 pp. (UF767 Un3.1an Contin.)

9518* Sintered High Melting Point Tungsten Alloys. The significance of W in respect to high melting point and its position in the periodic table is discussed. Alloys of W with the metals of groups 4a-8a are described. Suggestions are made concerning the shape of the W-V constitutional diagram. The systems W-Nb and W-Ta are described and properties of W-Nb and W-Ta alloys are enumerated. (*In German.*) Gesinterte hochschmelzende Wolframlegierungen. ***Richard Kieffer, Karl Sedlatschek, and Horst Braun.*** *Zeitschrift für Metallkunde,* v. 50, Jan. 1959, p. 18-24.

9519* Production and Properties of Sintered Nickel Aluminide Materials. Highest resistance to scaling is obtained in sinter alloys with 80 to 84% Ni. An oxidizing heat treatment increases the strength of the alloys. At 500 C, maximum tensile strength of 80 kg/mm^2 is reached. The alloys and their processing are described in detail. (*In German.*) Herstellung und Eigenschaften von Nickelaluminid-Sinterwerkstoffen. ***Erich Fitzer and Peter Gerasimoff.*** *Zeitschrift für Metallkunde,* v. 50, Apr. 1959, p. 187-196.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

9520 Fluoroscopy Proves Fast Method in Checking Honeycomb Panels. Fluoroscopy bears the burden of quality control eliminating costly processing and interpreting of film. ***W. R. Bear and W. S. Diehl.*** *Iron Age,* v. 183, no. 19, May 7, 1959, p. 106-108.

9521* Ultrasonic Attenuation in Cast Aluminum. Since radiography does not clearly distinguish the difference between high-quality aluminum castings and the ordinarily acceptable grade, there is a need for a nondestructive test method for this purpose. Aluminum test plates (7% Si–0.3% Mg) were cast with a chill on one edge and a riser at the opposite edge. Near the chill the properties are 38,000 psi ultimate tensile strength, 26,000 psi yield strength and 8% elongation. Near the riser the properties fall off to 33,000 psi ultimate tensile strength, 26,000 psi yield strength and 2% elongation. Ultrasonic attenuation measurements were made at various locations in the plates. There was a definite increase in attenuation in a direction away from the chill edge. Other experiments have been made on samples (5% Si) with various gas contents. It is shown that the attenuation characteristics are markedly affected by the presence of gas and microshrinkage in the samples. Techniques for making ultrasonic attenuation measurements on commercial castings were not considered in this paper. ***H. Smolen and H. Rosenthal.*** *Modern Castings,* v. 35, May 1959, p. 55-60.

9522 Ultrasonics Detects Faulty Bonding. An ultrasonic gage is saving hundreds of dollars by providing a simple, fast, and reliable nondestructive test method. Each blank to be tested is coated with a thin film of oil or glycerin for good sonic energy transmission. Then a quartz transducer is held to the laminated blank. A crystal, excited by an electronic sweep oscillator, vibrates over a range of frequencies, transmitting continuously varying ultrasonic waves into the material. Internal discontinuities appear on the screen as an incomplete trace, an absence of traces, or a difference in spacing. Access to one side only is required. The material is not harmed or marked. *Steel,* v. 144, Apr. 20, 1959, p. 89.

9523 The Rating of the Quality of Uranium Metals by Microscopic Stringer Counts. Basis of the method is to count the total length of stringers in a polished sample at 100 magnification with the aid of a one-half inch square ruled grid screen .The rating method was able to distinguish a difference in the quality of metal as produced by two manufacturers. ***S. J. Broderick and A. J. Busch.*** *U. S. Atomic Energy Commission, NBL*-152, Feb. 1959, 23 pp. (UF767 Un3.1nb Contin.)

9524 Implications of Ultrasonic Attenuation to Nondestructive Testing. In order to relate ultrasonic inspection data to actual conditions inside a metal part, it is essential that the inspector have some knowledge of attenuation. This paper briefly reviews the theory of attenuation of ultrasonic energy. It discusses the first part of a study being conducted for the purpose of understanding and evaluating the large losses encountered in cast and welded steels. The equipment required and techniques employed for measuring attenuation are described. The results of these attenuation measurements are described with special reference to weld inspection. ***J. K. White, R. W. McClung, and J. W. Allen.*** *U. S. Atomic Energy Commission, ORNL*-2651, Apr. 14, 1959, 17 pp. (UF767 U3o Contin.)

See also: **8912** (nondestructive thickness measurement of organic coatings); **8942** (radiation coating thickness gage); **9355** (surface roughness of castings).

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

9525* On the Determination of Absolute Internal Conversion Coefficients by the Comparison of Conversion Lines and Photolines. An Application to the 662 keV Transition in the Decay of Cs^{137}. ***Sölve Hultberg and Rune Stockendal.*** *Arkiv för Fysik,* v. 14, no. 6, 1959, p. 565-577.

9526 Atomic Physics. v. II. Electricity, Magnetism, and Atomic Physics. The objective is to describe the fundamentals of the theory and practice associated with the study of electrons and ions in gases, the extra-nuclear structure of the atom, and the nucleus itself. It is hoped that the reader will obtain an appreciation of the extent of the creative activity that has been devoted to this vital branch of physics since the beginning of the twentieth century, and that he will, furthermore, learn the various methods of attack which have been used to solve problems in both experimental and theoretical work. ***John Yarwood.*** 644 pp. 1958. University Tutorial Press Ltd., London. (QC21 F43e)

9527* Reactor Fuel Life—The Reactivity Limits. Reactor fuel has a definite life, on nuclear physics considerations, due to an ultimate loss of reactivity. The author discusses this limit, and the way in which fuel cycling can attain the best results with fuel elements by ensuring that each is fully "burnt". ***P. J. Grant.*** *Atomic World,* v. 10, Apr. 1959, p. 132-135.

9528* Reactor Fuel Life—The Metallurgical Limits. Changes in natural uranium metal, brought about by irradiation, will cause the elements to fail before the limit set by reactivity considerations. The metallurgical problems are analyzed. ***M. D. Jepson.*** *Atomic World,* v. 10, Apr. 1959, p. 136-139.

9529* Control of Reactors by Enriched "Shim-Elements". Reactor control, with respect to xenon-poisoning, can be improved by the use of movable "shim-elements" with a higher enrichment in fissionable materials compared to the fuel substance. (*In German.*) Zusatzsteuerung von Leistungsreaktoren durch angereicherte Ausgleichselemente. ***D. Smidt.*** *Atomkernenergie,* v. 4, Apr. 1959, p. 129-131.

9530* Nuclear Physics Measurement Methods. VIII. Nuclear Radiation Spectrometry. (*In German.*) Kernphysikalische Messmethoden. VIII. Spektrometrie mit Kernstrahlung. ***Werner Braunbek.*** *Atomkernenergie*, v. 4, Apr. 1959, p. 151-153.

9531* Bibliography of Technical Reports on the Effects of Fallout. Compiled from a search of the report literature up to July 1, 1958. A list of bibliographies of published works on radiation effects is included. ***Roger Wallace.*** 70 pp. July 1958. Office of Technical Services, Department of Commerce, Washington, D. C. (ZUF767 Un3.1b Ref.)

9532 Čerenkov Radiation and Its Applications. *J. V. Jelley.* 304 pp. 1958. Pergamon Press, New York. (QC475 J39c)

9533* Effects of Impurities in Sodium Chlorate Detected by Nuclear Quadrupolar Resonance. A widening and a displacement of the resonance of ^{35}Cl in ClO_3Na were caused by low concentrations of impurities. These phenomena were interpreted by disturbances of the crystalline network and in relation to the elastic theory. (*In French.*) **Effets d'impuretés dans le chlorate de sodium par la résonance quadrupolaire nucléaire.** ***Albert Douillet and Bernard Dreyfus.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 14, Apr. 6, 1959, p. 2087-2089.

9534* Quasi-Elastic Diffusion of Rapid Nucleons Through Light Nuclei. Effect of the Complex Potential. The differential effective section of quasi-elastic diffusion (p, pn) and (p, 2p) of the protons of 155 and 340 MeV was calculated, account being taken of the distortion of the waves of the incidental proton and of the two nucleons emitted by a complex nuclear potential. (*In French.*) Diffusion quasi élastique des nucléons rapides par les noyaux légers. Influence du potentiel complexe. ***Nadine Bessis.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 15, Apr. 13, 1959, p. 2168-2170.

9535 Radioisotopes. A New Dimension for Applied Science. A review. ***W. E. Barbour, Jr.*** *Electrical Engineering*, v. 78, May 1959, p. 423-434.

9536* "Jason" Reactor for Training and Research. A 10kW research reactor based on the "Argonaut" design is a simple inherently-safe thermal heterogeneous reactor suitable for universities and technical colleges. *Engineer*, v. 207, Apr. 10, 1959, p. 582-584.

9537 Atomic Light. Illumination From Radioactive Sources. The emissions from certain radioactive isotopes may be translated by way of luminescent phosphors directly into light. Light sources, based on this principle, requiring no external source of power and operating over long periods without attention, have been developed at the Atomic Energy Research Establishment, Harwell. ***E. J. Wilson and J. D. H. Hughes.*** *Engineering*, v. 187, Apr. 17, 1959, p. 497-499.

9538 Fundamental Aspects of Reactor Shielding. *Herbert Goldstein.* 416 pp. 1959. Addison-Wesley Publishing Co., Reading, Mass. (TK9210 C57f)

9539* Disposal of Radioactive Wastes From Nuclear Power Reactors. *W. J. L. Kennedy.* *Industrial Wastes*, v. 4, no. 3, May 1959, p. 44-47.

9540 Radiation Effects on Insulation, Wire, and Cable. The authors provide an excellent summary of available information regarding radiation effects. Although each insulation material is discussed in as brief a manner as possible, nearly all significant points are covered. This article deals with radiation effects produced by γ-rays, and fast and slow neutrons on specific elastomers and plastics. ***C. J. Lyons and R. I. Leininger.*** *Insulation*, v. 5, May 1959, p. 19-26.

9541 Materials for Nuclear Reactors. Some 30 authors present a systematic, comprehensive treatment of the atomic fuel cycle, and of the preparation, properties, and behavior of the important materials in reactors. ***Bernard Kopelman, editor.*** 411 pp. 1959. McGraw-Hill, New York. (TK9202 K83m)

9542* Nuclear Engineering Handbook. *Harold Etherington, editor.* Sections individually paged. 1958. McGraw-Hill, New York. (TK9145 N88 Ref.)

9543* Magnetic Measurements on the Cornell Alternate Gradient Synchrotron. A summary of the factors leading to a choice of field gradient, and a description of the pole tip design. ***E. Malamud and A. Silverman.*** *Nuclear Instruments and Methods*, v. 4, Mar. 1959, p. 67-78.

9544* K-Capture to Positon Branching Ratios in the Decay of Ga^{68}. The above were using coincidence scintillation spectrometer techniques. The measured values are 1.28 ± 0.12 (to the first excited state) and 0.10 ± 0.02 (to the ground state). ***M. K. Ramaswamy.*** *Nuclear Physics*, v. 10, no. 3, Mar. 1959, p. 205-212.

9545* Cross Sections for Some (n, p) and n, α) Reactions. The $Mg^{24}(n,p)Na^{24}$, $Al^{27}(n,\alpha)Na^{24}$, $Si^{28}(n,p)Al^{28}$, $Cr^{52}(n,p)V^{52}$ and $Fe^{56}(n,p)Mn^{56}$ reactions were measured for neutrons produced by the $H^3(d,n)He^4$ reaction. ***B. D. Kern, W. E. Thompson, and J. M. Ferguson.*** *Nuclear Physics*, v. 10, no. 3, Mar. 1959, p. 226-234.

9546 Temperature and Reactivity. Performance of power reactors is very sensitive to changes in temperature in both fuel and moderator. Summarizes the main effects, with special emphasis on GCRs. ***J. J. Syrett.*** *Nuclear Power*, v. 4, May 1959, p. 95-97.

9547 Radiation Detectors. III. Their Operating Limitations. Considers how the response to unwanted radiation influences detector choice. ***A. L. Gray.*** *Nuclear Power*, v. 4, May 1959, p. 103-105.

9548 A Status Report on SDR. The feasibility of the Sodium-Deuterium Reactor concept has been demonstrated experimentally and the design of a particular reactor system has been completed. ***E. Bernsohn, J. Duffy, C. K. Leeper, and M. S. Silberstein.*** *Nucleonics*, v. 17, May 1959, p. 112-115.

9549 Thermal-Resistance Concept Aids Fuel-Temperature Calculations. A convenient way to calculate the temperature distribution in a reactor fuel element, given the heat flux, mass flow rate and physical properties of the unit fuel cell, based on the use of precalculated thermal resistances for the fuel regions in the path of the heat flow. ***Warren M. Rohsenow, J. P. Barger, and Jeffery Lewins.*** *Nucleonics*, v. 17, May 1959, p. 150 + 6 pages.

9550 SNAP-III—Electricity From Radionuclides and Thermoelectric Conversion. Tabulates characteristics of a fully fueled SNAP-III generator. ***Melvin Barmat, G. M. Anderson, and E. Wayne Bollmeier.*** *Nucleonics*, v. 17, May 1959, p. 166 + 5 pages.

9551 The Scintillation Counter. Describes the scintillation counter marketed by Philips and discusses the physical principles underlying the operation of a scintillation counter, and the disturbing effects of inherent noise and background radiation which must be reckoned with both by the designer and by the user of such equipment. ***J. A. W. van der Does de Bye.*** *Philips Technical Review*, v. 20, no. 8, Mar. 1959, p. 209-219.

9552 Nuclear Magnetic Resonance in Silver-Cadmium. Shifts and line widths have been measured in the alloys at 300 K in a field of 4200 gauss. ***L. E. Drain.*** *Philosophical Magazine*, v. 4, ser. 8, Apr. 1959, p. 484-501.

9553 Theory of Many-Boson Systems: Pair Theory. The theory is treated by a variational method based on a variational trial state of an exponential pair-excitation type obtained by a generalization of that of Bogoliubov; the treatment is closely related to an intermediate-coupling approximation with respect to pairs. ***M. Girardeau and R. Arnowitt.*** *Physical Review*, v. 113, ser. 2, no. 3, Feb. 1, 1959, p. 755-761.

9554 Contribution of Annihilation Radiation to the Gamma-Ray Flux in Lead. Numerical results are presented for primary radiation sources with energies between two and ten Mev in a lead medium. These results can be represented by simple semi-empirical formulas. ***Martin J. Berger, J. H. Hubbell, and Ida H. Reingold.*** *Physical Review*, v. 113, ser. 2, no. 3, Feb. 1, 1959, p. 857-862.

9555 Slow-Neutron Scattering by Rotators. The methods of Zemach and Glauber for treating the above are extended for the rotational degrees of freedom to any type of rotator.

Howard C. Volkin. *Physical Review*, v. 113, ser. 2, no. 3, Feb. 1, 1959, p. 866-874.

9556 Neutral *K* Meson as a Particle Mixture. Experiment was designed to demonstrate the recently predicted particle-mixture property of the neutral *K* meson. Twenty thousand pictures, corresponding to about 3 x 10^5 pions incident on the aluminum, were scanned for V° events. About 14 Λ° decays and about 12 $\Theta 1^\circ$ decays were observed. ***William B. Fowler, Richard L. Lander, and Wilson M. Powell.*** *Physical Review*, v. 113, ser. 2, no. 3, Feb. 1, 1959, p. 928-934.

9557 *V-A* Theory and the Decay of the Λ Hyperon. Decay is studied within the framework of the chirality-invariant four-fermion interaction. It is shown that the branching ratio of the charged and neutral modes, the *s*- to *p*-wave emission, as well as the sign and magnitude of the asymmetry parameter of the $p + \pi^-$ decay mode, can be understood on the basis of the *V-A* theory. ***S. Okubo, R. E. Marshak, and E. C. G. Sudarshan.*** *Physical Review*, v. 113, ser. 2, no. 3, Feb. 1, 1959, p. 944-954.

9558 Many-Body Problem in Quantum Statistical Mechanics. I. General Formulation. A formulation is given whereby the grand partition function of a many-body system satisfying Bose-Einstein or Fermi-Dirac statistics is expressed in terms of certain U functions defined for the same system with Boltzmann statistics. ***T. D. Lee and C. N. Yang.*** *Physical Review*, v. 113, ser. 2, no. 5, Mar. 1, 1959, p. 1165-1177.

9559 Halogen Delayed-Neutron Activities. A gas-flow technique was developed to make rapid chemical separations of Br and of I fission products from a solution of U^{235} irradiated with thermal neutrons. The active Br or I is observed by its delayed neutron emission. ***Gilbert J. Perlow and Andrew F. Stehney.*** *Physical Review*, v. 113, ser. 2, no. 5, Mar. 1, 1959, p. 1269-1276.

9560 Determination of the Absolute Neutron Fission Cross Section of U^{235}. Absolute cross section of U^{235} at 0.0253 ev was determined by measuring (σ_i/σ_f) at 5.3 A and combining this with scattering, absorption, and relative fission cross section measurements. ***George J. Safford and Edward Melkonian.*** *Physical Review*, v. 113, ser. 2, no. 5, Mar. 1, 1959, p. 1285-1293.

9561 Multiple Meson Production by Photons in Hydrogen. Pictures of a H_2 diffusion cloud chamber with magnetic field taken at the 1.1-Bev Cornell synchrotron were analyzed to study mutiple meson production by photons on protons. They yielded 108 cases of double charged meson production ($\gamma + p \rightarrow p + \pi^+ + \pi^-$) and 4 cases of triple meson production. ***J. M. Sellen, G. Cocconi, V. T. Cocconi, and E. L. Hart.*** *Physical Review*, v. 113, ser. 2, no. 5, Mar. 1, 1959, p. 1323-1329.

9562 Neutral Cascade Hyperon Event. Presents a bubble chamber photograph, and a diagram of the event. ***Luis W. Alvarez, et al.*** *Physical Review Letters*, v. 2, no. 5, Mar. 1, 1959, p. 215-219.

9563 Soft X-Rays From a Magnetically Compressed Plasma in Scylla. ***K. Boyer, et al.*** *Physical Review Letters*, v. 2, no. 7, Apr. 1, 1959, p. 279-280.

9564 Resonance Capture of Neutrons in Infinite Homogeneous Media. The variational principle is used together with simple but accurate trial functions to obtain expressions for corrections to the commonly used "narrow resonance" formula for capture and interference effects in the capture of neutrons by closely spaced resonances. ***R. Schermer and N. Corngold.*** *Physical Society, Proceedings*, v. 73, pt. 4, Apr. 1959, p. 561-571.

9565 Proceedings of the Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Held in Geneva, Sept. 1-13, 1958. v. XIX. The Use of Isotopes: Industrial Use. 366 pp. 1958. United Nations, Geneva. (QC770 In8p2 Over.)

9566* Global Symmetry and Isotopic Spin Conservation in Non-Leptonic Hyperon Decays. The observed deviations from the expected symmetries in actual decays are explained as effects due to the mesonic structure of hyperons. ***Gyo Takeda and Masaaki Kato.*** *Progress of Theoretical Physics*, v. 21, no. 3, Mar. 1959, p. 441-451.

9567* The Impact of the Atom on Present Sources of Energy. Concludes with the belief that any pessimism on the future of nuclear energy, either by fission or by fusion, as well as on other future sources of energy, is groundless. ***Robert E. Wilson.*** *Ricerca Scientifica*, v. 29, Jan. 1959, p. 3-13.

9568 Half-Life of Sulfur-35. A new determination of the half-life of this beta emitter shows it to be 86.35 ± 0.17 days. ***Raymond D. Cooper and Eugene S. Cotton.*** *Science*, v. 129, May 15, 1959, p. 1360-1361.

9569 On the Theory of the Polarization of Nucleons by Deuterons. The von Neuman density matrix and Racah algebra have been used to derive expressions for the average value of the spin operator in the emerging beam of nucleons after single and double scattering from unpolarized deuterons. ***Kenneth Smith and Murray Peshkin.*** *U. S. Atomic Energy Commission, ANL-5910*, Apr. 1959, 371 pp. (UF767 Un3.1an Contin.)

9570 Radioactive Waste Management at Oak Ridge National Laboratory. The collection, treatment, disposal, and monitoring of radioactive wastes (solid, liquid, and gaseous) at Oak Ridge National Laboratory are described in detail. ***F. N. Browder, editor.*** *U. S. Atomic Energy Commission, ORNL-2601*, Apr. 17, 1959, 59 pp. (UF767 U3o Contin.)

9571 The Triax Pinch Device. The Triax device is a discharge tube in which a plasma carrying a current is pinched into the form of a cylinder between two concentric copper cylinders, each of which carries part of the return current. The nature of the neutron production occurring has not yet been established, and although certain arguments are presented that make it not inconceivable that it is thermonuclear, a search for a nonthermonuclear origin is continuing. ***O. A. Anderson, et al.*** *U. S. Atomic Energy Commission, UCRL-8153*, Jan. 1958, 41 pp. (UF767 U3u Contin.)

9572* Vacuum System for a Thirty Billion Electron Volt Particle Accelerator. The vacuum chamber is a torus one-half mile in circumference with a cross-section of 3 in. by 7 in. Approximately fifty getter-ion type pumps will be used on the ring to give the required pressure of 2 x 10^{-6} mm. Hg. This does not include the linear accelerator injector. ***C. L. Gould.*** *Vacuum*, v. 9, no. 1, Mar. 1959, p. 63-68.

9573* Energy-Range Relation of 660 MeV Protons. The mean range of protons in Cu was found to equal (257.6 ± 1.2) g/cm². (*In Russian.*) Sootnoshenie probeg–energiia dlia protonov 660 MeV. ***V. P. Zrelov and G. D. Stoletov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 3, Mar. 1959, p. 658-668.

9574* Underground μ-Meson Spectrum at a Depth of ~ 40 *m* Water Equivalent. A magnetic spectrometer was employed to measure the momentum spectrum of μ-mesons at a depth of ~ 40 *m* water equivalent in the 2.10^9 to 5.10^{10} eV/*c* momentum range. (*In Russian.*) Spektr μ-mezonov pod zemleĭ na glubine, ekvivalentnoĭ ~ 40 *m* vody. ***M. I. Dajon and L. I. Potapov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 3, Mar. 1959, p. 697-706.

9575* Ionization Along the Tracks of High Energy Electron-Positron Pairs. Experimental data are presented on the track densities of five high energy electron-positron pairs in nuclear emulsions, determined from the grain density in the track and from the gap length distribution coefficient. (*In Russian.*) Ionizatsiia vdol' sledov elektronno-pozitronnykh par vysokoĭ energii. ***A. A. Varfolomeev, et al.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 3, Mar. 1959, p. 707-716.

See also: **9060** (U. S. fuel economics); **9242** (nuclear energy exhibition); **9752** (welding reactor metals); **9779** (welding applications in APPR-1)

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

9576 Management's International Mission. The author, president of Standard Oil Co. of Calif., discusses the global operations of big business. ***T. S. Petersen.*** *Analysts Journal*, v. 15, no. 2, May 1959, p. 9-13.

9577 Basic Motion Timestudy. Combines the theory of motion indentification and timing with useful methods of applying the resulting time data to manual activities. ***Gerald B. Bailey and Ralph Presgrave.*** 195 pp. 1958. McGraw-Hill, New York. (T60.M65 B15b)

9578 Company, Climate and Creativity. Important problems in the area of creativity in industry—identifying creative talent, group ideational techniques, etc.—have, of late, been vigorously investigated. On the other hand, relatively little attention has been accorded to the problem, perhaps fundamentally more important, of how to establish an organizational climate which maximizes the production of creative ideas. Industrial Relations News, an affiliate of Deutsch and Shea, Inc., technical manpower consultants, surveyed the opinions of 105 well-known scientists and administrators. ***Deutch & Shea, Inc., compilers.*** 103 pp. 1959. Industrial Relations News, New York. (BF408 D48c)

9579 Management Odyssey With a Practical Payoff. How RCA's Electron Tube Division keeps middle and lower management in touch with top management's thinking. *Dun's Review and Modern Industry*, v. 73, no. 5, May 1959, p. 115-117.

9580 How Good Are Your Decisions? Simple Arithmetical Checks. Every day engineers and managers have to make decisions spontaneously without interruption to the pattern of their thinking. Simple statistical rules, involving nothing more than elementary arithmetic, are suggested so that account can be taken of numerical data which might otherwise seem imponderable or have to be neglected. ***W. E. Duckworth.*** *Engineering*, v. 187, Apr. 10, 1959, p. 459-460.

9581 Foremanship Training in the British Foundry Industry. This article describes the organizations in the United Kingdom, both within, and outside, the foundry industry, which cater for the education of foundry administrative personnel. ***F. C. Hayes.*** *Foundry Trade Journal*, v. 106, Apr. 9, 1959, p. 419-421.

9582 The Project Manager. Generally speaking, the project manager's business is to create a product—a piece of advanced-technology hardware. The primary tool available to him is the brainpower of men who are professional specialists in diverse fields. He uses this tool in all the phases of the creation of his product, from concept through the initial test operation and manufacturing stages. ***Paul O. Gaddis.*** *Harvard Business Review*, v. 37, no. 3, May-June 1959, p. 89-97.

9583 Business Decision Making. The problem of how executives and others make decisions within business organizations. ***James G. March.*** *Industrial Research*, v. 1, no. 2, Spring 1959, p. 65-70.

9584 Motivating the Technical Mind. How motivational research finds out what makes technical people tick. ***Ernest Dichter.*** *Industrial Research*, v. 1, no. 2, Spring 1959, p. 71-76.

9585 Merit Rating and Productivity in an Industrial Research Laboratory: A Case Study. A merit rating plan based only on one criterion, over-all performance, was tested in one section of approximately sixty engineer-scientists in a large industrial research laboratory. The procedure used is discussed along with some general results. ***Alexander G. Grasberg.*** *IRE Transactions on Engineering Management*, v. EM-6, no. 1, Mar. 1959, p. 31-37. (TK1 In6.6em Vis.)

9586* The Challenge of Operations Research. Discusses the unification of operations research and industrial engineering. ***R. N. Lehrer.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 87-90.

9587* The Economic Management of Methods Development and Industrial Engineering. Describes ULT (Unit Labor Index) which was developed to specify the action techniques of industrial engineering that were economically justified. The industrial engineering supervisors could thus be assured that engineers were using techniques likely to give the greatest return for their efforts. ***James W. Thompson.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 95-98.

9588* Measuring Physical Effort. ***Ingo Ingenohl.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 99-114.

9589* Construction of Linear Programming Model. By careful applications of the methods described in this paper, all problems of linear programming can be accurately translated from a verbal description to a mathematical model ready for solution. ***Paul H. Randolph.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 118-121.

9590* A Scheduling Problem. An Analytical Solution Based Upon Two Machines, n Jobs, Arbitrary Start and Stop Lags, and Common Sequence. ***L. G. Mitten.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 131-135.

9591* A Control Procedure Applied to Subjective Evaluations. The purpose of this paper is to discuss a control system which will evaluate the inherent variability of decisions made by people. ***William G. Howe and Robert W. Peacor.*** *Journal of Industrial Engineering*, v. 10, no. 2, Mar.-Apr. 1959, p. 138-143.

9592* Information Flow and Worker Productivity. Tells what information should be where and at what time for proper internal decision making. In accordance with general principles of communication which recent research has spelled out, this article demonstrates a system which appears to concentrate on providing a high probabilty of (1) aiding members of the group in making right decisions; (2) providing a basis for rational behavior; (3) leaving room for individual group members to make their own decisions. ***Alan S. Goldman.*** *Management Science*, v. 5, no. 3, Apr. 1959, p. 270-278.

9593* Developing From an Engineer to an Administrator. To become an administrator, an engineer must (a) possess or acquire a knowledge of the principles and techniques, (b) have the necessary personal qualifications, (c) be able to apply the scientific method of thought to a variety of problems. ***Oliver J. Sizelove.*** *Mechanical Engineering*, v. 81, Apr. 1959, p. 54-55.

9594 What About Management Courses? The author, a professor at George Washington University, advises those in middle management to consider the benefits offered by various kinds of management courses. ***Gilbert C. Jacobus.*** *Petroleum Engineer*, v. 31, May 1959, p. E1-E4.

9595 Production Planning and Inventory Control. Gives a thorough explanation of the latest ideas and techniques of inventory control and production planning, along the lines of operations research thinking. The basic functions of inventories, and the different policies and costs which affect inventory and production planning decisions, are fully covered and show how these elements relate to one another, how they can be used effectively, and how they are balanced to arrive at a sound inventory policy. ***John F. Magee.*** 333 pp. 1958. McGraw-Hill, New York. (T56 M27p)

9596 An Analysis of Managerial Control. The ideal solution is the automatic paperwork factory connected by machines to the automatic goods-producing factory. This article outlines the problem. ***John D. Dillon.*** *Systems*, v. 23, no. 2, Mar.-Apr. 1959, p. 24-25.

9597* What Is Quality Control? Modern quality control is firmly based on the application of statistical methods to the analysis of manufacturing problems. These quality problems involve scrap, raw material, incoming parts, work in process, and finished product. ***Charles H. Joseph, Jr.*** *Tooling & Production*, v. 25, no. 2, May 1959, p. 35-36.

9598* Statistical Basis of Attribute Sampling. A description of the logical (and statistical) basis for attribute sampling, showing its applicability to attaining quality standards in your own plant. ***James V. Strela.*** *Tooling & Production*, v. 25, no. 2, May 1959, p. 56 + 2 pages.

See also: **9357** (linear programming in foundries).

ORE AND MATERIALS BENEFICIATION

9399* The Causal Mechanism Underlying the Formation of Electrochemical Heterogeneities on the Surface of Sulfide Minerals. Shows the effects of the adsorption processes, especially physical adsorption on the change of potential between different parts of the surface of sulfide minerals, that provoke the appearance of electrochemical heterogeneities which influence the distribution of the flotation agents on the surface of the minerals in the flotation pulp. (*In Russian.*) K voprosu o mekhanizme voznikoveniia elektrokhimicheskoi neodnorodnosti poverkhnosti sul'fidnykh mineralov. ***I. N. Plaksin and R. Sh. Shafeev.*** *Akademiia Nauk SSSR, Doklady*, v. 125, no. 3, Mar. 21, 1959, p. 599-600 + 1 plate.

9600* Efficient Handling Key Link in Taconite Processing. Since the plant operates around-the-clock throughout the year, provision was made to stockpile about 4 million long tons of pellets with a belt conveyor stacker when winter closes the Great Lakes to navigation. These large quantities of materials require handling facilities and processing equipment that automatically perform with a minimum of supervision. *Automation*, v. 6, May 1959, p. 64-72.

9601* Heavy Media Enriching of the Lead-Zinc Ores of Gyöngyösoroszi. (*In Hungarian.*) A gyöngyösoroszi ólomcinkércek nehézszuszpenziós dúsitása. ***Andres Gaygi Pálffy.*** *Bányászati Lapok*, v. 92, nos. 2-3, Feb.-Mar. 1959, p. 73-91.

9602* Possibility of Ilmenite Recovery and Vanadium Enriching From "Wehrlite and Ultrabasite" Rocks. (*In Hungarian.*) Ilmenit kinyerés és vanádium dúsítás lehetősége a wehrlit és ultrabazit kőzetekből. ***László Visnyovszky.*** *Bányászati Lapok*, v. 92, nos. 2-3, Feb.-Mar. 1959, p. 127-133.

9603 Capryl Pyrophosphate Ester Extracts Uranium From Wet-Process Phosphoric Acid. This Florida company now employs its own solvent-extraction process to produce a substantial tonnage of UF_4 byproduct. *Chemical Engineering*, v. 66, May 4, 1959, p. 35-38.

9604 New Contactor Unravels Difficult Ore. High in clay, low in valuable mineral, a difficult Colorado ore yields U through upgrading and recovery in thickener-type exchangers. *Chemical Engineering*, v. 66, May 4, 1959, p. 52 + 1 page.

9605 Circulating Magma Crystallizers. Performance characteristics and operating details of magma crystallizers, including scale-up problems, recent design concepts, and applications details. ***Hobart H. Newman and Richard C. Bennett.*** *Chemical Engineering Progress*, v. 55, Mar. 1959, p. 65-70.

9606 McLouth Steel Puts Self-Fluxing Sinter Line Into Operation. *Iron and Steel Engineer*, v. 36, Apr. 1959, p. 144-146.

9607* The Influence of Sodium Silicate and Sodium Oleate on the Flotation of Pyrochlor and Zircon by Sodium Alkyl Sulphate. (*In Russian.*) O vliianii zhidnogo stenla i oleata natriia na flotatsiyn pirokhlora i tsirkona alkilsul'fatom natriia. ***G. M. Shapovalov and S. I. Polkin.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1959, no. 1, p. 20-25 + 1 plate.

9608* On the Mechanism of Kerosene Action in Flotation. The main function of kerosene as flotation agent consists in a reduction of the contact time between the mineral particle and the air bubble necessary for the adhesion. (*In Russian.*) O Mekhanizme deystviia kerosina pri flotatsii. ***S. I. Krokhin and R. I. Cheremukhina.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1959, no. 1, p. 26-40 + 1 plate.

9609 Sponge Iron by the HYL Process. Production and utilization of sponge iron from a new process in Mexico. ***F. Weston Strarratt.*** *Journal of Metals*, v. 11, May 1959, p. 315-318.

9610* Study on the Floatability of Mineral Particles in the Presence of Surface Active Agents. I. Relation Between Adsorption of the Collector Ion and the Electrokinetic Potential in Flotation. The electro-osmotic velocity, the adsorption density and the floatability of mineral particles were measured for the following systems: fluorite-sodium dodecyl benzene sulphonate, quartz-sodium dodecyl benzene sulphonate, quartz-octadecyl dimethyl benzyl ammonium chloride, scheelite-octadecyl dimethyl benzyl ammonium chloride, and quartz-dodecyl ammonium acetate. ***Shigeru Mukai, Gentaro Kano, and Takeo Matsubara.*** *Kyoto University, Memoirs of the Faculty of Engineering*, v. 21, pt. 1, Jan. 1959, p. 40-56.

9611 University Session on Fluidizing Reactors. Symposium at the University of Arizona for wider dissemination of data on use of this air-suspension roasting method. *Mining Engineering*, v. 11, Apr. 1959, p. 414-420.

9612* Ore-Dressing Notes. Magnetic separation; phosphate flotation; uranium mill. *Mining Magazine*, v. 100, no. 4, Apr. 1959, p. 216-218.

9613* Automated Quality Control at Kiruna. This Swedish iron ore concentrating plant treats a feed that is highly variable in composition. The concentrate must be split into five different grades. Data processing must be mechanized for control and dispatch of ore cars. ***Axel W. Kjelgaard.*** *Mining World*, v. 21, no. 6, May 1959, p. 32-37.

9614 How to Use Molecular Sieves for Natural-Gas Treating. In natural-gas drying, sieves can provide twice the dehydration capacity of conventional desiccants while providing longer life. In natural-gas sweetening, progress has been made in developing a process using a single-stage rapid-cycle drying and sweetening unit. ***E. L. Clark.*** *Oil and Gas Journal*, v. 57, no. 18, Apr. 27, 1959, p. 120-123.

9615* The Separation of Kieserite From Rock Salt by Flotation, Using Sodium Mersolate as a Collector. Deals with the possibility of separating kieserite in the flotation residue from the separation of KCl from the Klodawa carnallite-kieserite salt. (*In Polish.*) Oddzielanie kizerytu od soli kamiennej przez flotacje przy użyciu mersolanu sodowego jako zbieracza. ***Edward Bunter, Stanisława Nowak, and Maria Klimek.*** *Przemysł Chemiczny*, v. 38, no. 2, Feb. 1959, p. 99-101.

9616* Manufacture of Open-Hearth Sinter From Local Iron Ores at the Kuznetsk Metallurgical Combine. The successful use of existing flow sheets at the Abagur and Mundybash Concentration Plants of the Kuznetsk Metallurgical Combine (KMC) to get concentrates, sufficiently rich in iron, for manufacture of sinter suitable for the open-hearth process (to replace the Magnitogorsk open-hearth iron ores). (*In Russian.*) Proizvodstvo martenovskogo aglomerata iz mestnykh rud KMK. ***K. F. Marchenko.*** *Stal'*, v. 19, no. 4, Apr. 1959, p. 311-313.

9617* Studies on the Roasting of Sulfide Ores. I. On the Reaction Pressure Between Zinc Sulfide and Zinc Sulfate. ***Motoo Watanabe and Toshiaki Yoshida.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A, Physics, Chemistry, Metallurgy*, v. 2, no. 1, Feb. 1959, p. 66-72.

9618 Precipitation of Manganese Dioxide. The reaction of Mn^{++} with MnO_4^- under vigorous agitation produces a precipitate of MnO_2 that can be easily centrifuged from the supernatant. Increased temperature improved the ease of centrifugation. The effects are interpreted in terms of the kinetics of the precipitation. ***James T. Grace, Hugh E. Henry, and David G. Karraker.*** *U. S. Atomic Energy Commission, DP-346*, Dec. 1958, 10 pp. (UF767 Un3.1dp Contin.)

9619 The Fused Salt-Fluoride Volatility Process for Recovering Uranium. Description of a process for recovering enriched U from UF_4-NaF-ZrF_4 melts, produced by the dissolution of reactor fuel elements in molten NaF-ZrF_4 through hydrofluorination. ***G. I. Cathers, M. R. Bennett, and R. L. Jolley.*** *U. S. Atomic Energy Commission, ORNL-2661*, Apr. 15, 1959, 35 pp. (UF767 U3o Contin.)

9620 Cadmium. A materials survey. ***Robert L. Mentch and Arnold M. Lansche.*** *U. S. Bureau of Mines Information Circular* 7881, 1958, 43 pp. (TN21 Un3i Vis.)

9621 Volatilization of Tin Chloride From Bolivian Slimes. Develops methods, on a laboratory scale, for recovering tin from Bolivian metallurgical slimes. High percentages of the total tin were volatilized as chlorides at temperatures below 600 C. Owing to the low temperatures involved and the high yields of tin, the process was considered to have possibilities for treating Bolivian slimes on a commercial basis. ***K. Kershner and A. A. Cochran.*** *U. S. Bureau of Mines Report of Investigations* 5459, 1959, 12 pp. (TN21 Un3r Vis.)

9622* Thermochemical and Kinetic Studies Relating to Thermal Magnesium Production. II. Formation of Calcium Silicide From Calcium Oxide and Silicon. III. Reduction of Calcinated Dolomite by Ferrosilicon Over 1050 C. (*In German.*) Thermochemische und kinetische Untersuchungen zur thermischen Magnesiumgewinnung. II. Die Bildung von Kalziumsilizid aus Kalziumoxyd und Silizium. III. Reduktion von gebranntem Dolomit mit Ferrosolizium oberhalb 1050 C. ***A Schneider, J. F. Cordes, H. Kribbe, and H. Runge.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 12, Apr. 1959, p. 164 + 8 pages.

9623* Extraction of Gallium as a By-Product of Aluminum Oxide Production. Geochemistry. Extraction from the Mansfeld Cu shale, from Zn ores, and from Al ores by the HCl, CO_2, lime and electrolysis process, and in particular, by the method of Bretèque using Hg electrodes. (*In German.*) Die Gewinnung des Galliums als Nebenprodukt der Aluminiumoxyderzeugung. ***K. Bielfeldt and M. Laspeyres.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 12, Apr. 1959, p. 173-178.

PHYSICS

9624 A Semi-Empirical Method of Calculating Reverberation Chamber Coefficients From Acoustic Impedance Values. Reverberation chamber coefficients have been calculated by this method for nine commercial materials at five standard frequencies using the acoustic impedance values given by Beranek. ***B. S. Atal.*** *Acustica*, v. 9, no. 1, 1959, p. 27-30.

9625* Electron Distribution and Energy Bands in Crystals of Metal Borides of the Type MB_6. Hybrids of *s*, *p* and *d* orbitals of the atomic *L* and *M* shells were used to describe the distribution of the valence electrons. Those linear combinations of the hybrid orbitals, which form a basis for the different irreducible representations of the symmetry group O_h, were found. Using these orbitals, Bloch wave functions were constructed. ***S. Flodmark.*** *Arkiv för Fysik*, v. 14, no. 6, 1959, p. 513-550.

9626* Systematic Study of Electron Binding Energies of Some Fourth and Sixth Period Elements by Means of the Photo Electron Method. A new precision method of measurement. The use of infinitely thick sources in β-spectroscopy is demonstrated. ***Evelyn Sokolowski.*** *Arkiv för Fysik*, v. 15, no. 1, 1959, p. 1-30.

9627* A Study of the Temperature Dependence of the Elementary Excitations in Helium II by the Use of Cold Neutrons. The dispersion curve of the elementary excitations in Helium II has been studied by observing the angular and energy distribution of cold neutrons scattered from liquid helium, in Stockholm and at Los Alamos. ***Karl-Erik Larsson and Kåre Otnes.*** *Arkiv för Fysik*, v. 15, no. 1, 1959, p. 49-63.

9628* Particle Acceleration in Plasma. A study of the physical principles underlying the new method of linear particle acceleration, where plasma wave-guides or non-compensated electron or ion beams are used as accelerators. The propagation of electromagnetic waves in the case of a narrow plasma waveguide was examined in nonlinear approximation. (*In Russian.*) Uskorenie chastits v plazme. ***Ia. B. Fainberg.*** *Atomnaia Energiia*, v. 6, no. 4, Apr. 1959, p. 431-446.

9629* A Nonlinear Theory of Slow Waves in a Plasma. Nonlinear study of the propagation of electromagnetic waves in a narrow plasma wave-guide. Relationship between the phase rate and the amplitude. Problem of the frequency multiplication. Existence of an amplitude of second harmonic. (*In Russian.*) K nelineinoi teorii medlennykh voln v plazme. ***Ia. B. Fainberg.*** *Atomnaia Energiia*, v. 6, no. 4, Apr. 1959, p. 447-452.

9630* Physical Consequences of a Unitary Theory. The Lorentz group is replaced by a new L_2 group; its structure (determined by homotopy) allows an interpretation of the electric full charge of elementary particles, gauge transformations, and particle conjugations. (*In French.*) Conséquences physiques d'une théorie unitaire. ***Jean-Marie Souriau.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 10, Mar. 9, 1959, p. 1478-1480.

9631* For a New Classification of the Elements of Matter. The arrangement described, similar to that of the electronic succession of atoms, but according to longitudinal layers as compared with the periodical distribution, presented here according to transversal electron layers, shows the equivalence of the diamagnetic properties and the disparity of the paramagnetic properties. (*In French.*) Pour une nouvelle classification des éléments de la matière. ***Rose Aynard.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 15, Apr. 13, 1959, p. 2165-2167.

9632 Proceedings of the Fourth Symposium on Magnetism and Magnetic Materials. Transactions include some 150 papers on theory and application. *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, 323 pp.

9633 Recent Developments in the Field of Elongated Single-Domain Iron and Iron-Cobalt Permanent Magnets. The experimental physical and magnetic properties of elongated single-domain permanent magnets have been previously reported and are briefly reviewed with respect to their means of preparation. A successful process is described for making ESD magnets available commercially at a limited initial rate. The material produced is described and contains elongated single-domain particles of iron or iron-cobalt embedded in a metallic matrix to protect them from environmental attack. Maximum magnetic energies of 2.2 megagauss-oersteds for iron and 3.6 megagauss-oersteds for iron-cobalt are available. ***R. B. Falk, G. D. Hooper, and R. J. Studders.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 132S-133S.

9634 Magnetism of Submicroscopical Iron Particles. The magnetic fields around submicroscopical iron particles were tested with iron oxide colloid in an electron microscope. The colloid particles usually spread evenly by diffusion. Magnetic fields of several hundred oersteds are required to concentrate the colloid particles visibly at certain spots. The colloid was attracted less by smaller particles; the smallest particles did not attract any colloid. ***Klaus J. Kronenberg.*** *Journal of Applied Physics* (Supplement), v. 30, Apr. 1959, p. 138S-139S.

9635 Permanent Magnet Lens Systems and Their Characteristics. Practical application of the double-gap lens system excited in parallel with a magnet; the two-stage lens system excited in parallel one or two magnets; the three-stage lens system with outside magnetic path; and the three-stage lens system excited with a permanent magnet and an electromagnet. ***Hirokazu Kimura and Yoshio Kikuchi.*** *Journal of Electronmicroscopy*, v. 7, 1959, p. 1-4.

9636 Liquid Helium. A review providing a detailed survey of the experimental results and presenting an exposition of the current state of the theory, with the emphasis being placed on physical significance. Liquid He is an outstanding example of a many-body problem, involving as it does the mutual interactions of a large number of He atoms. ***K. R. Atkins.*** 312 pp. 1959. The Syndics of the Cambridge University Press, New York. (QC284 At42L)

9637* Calculation of the *G* Factor for Gas Scattering Experiments. The case of a front aperture composed of two parallel edges of infinite height with a rear (detector) aperture of any shape is calculated up to terms in the fourth derivative of the cross section. ***Edward A. Silverstein.*** *Nuclear Instruments and Methods*, v. 4, Mar. 1959, p. 53-66.

9638* Surface Corrections to the Fermi-Thomas Statistical Theory. The Hartree-Fock equations are written in matrix form with the aid of the Dirac density matrix. The Fermi-Thomas theory is generalized so that these equations are explicitly satisfied for the diagonal elements and those lying near the diagonal. ***M. A. Naqvi.*** *Nuclear Physics*, v. 10, no. 3, Mar. 1959, p. 256-282.

9639* The Moiré Grating, a Versatile Test Object in Photoelectric Measurements of Aberrations. The Moiré grating is used to measure aberrations. By slightly changing its arrangement, one can carry out also Fourier transformations, phase measurements of thin layers, and analysis of color spectra. (*In German.*) Das Moiré-Gitter als vielseitiges Testobjekt: Photoelektrische Aberrationsmessung. ***A. Lohmann.*** *Optica Acta*, v. 6, no. 1, Jan. 1959, p. 37-41.

9640* Matrix Formalism in the Theory of Diffusion of Light. Matrices are introduced into the transport equation, in order to account for polarization effects. The necessary transformation of the scattering matrix is carried out by developing its components in generalized spherical functions. ***I. Kuščer and M. Ribarič.*** *Optica Acta*, v. 6, no. 1, Jan. 1959, p. 42-51.

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magnetism, treated in a rigorous manner from the viewpoint of a physicist. A modern atomic approach describes phenomena such as metallic conduction and the production of chemical and thermal emfs. The analysis of magnetic fields starts with the Lorentz force law. ***William Taussig Scott.*** 635 pp. 1959. John Wiley & Sons, Inc., New York. (QC521 Sc86p)

9663 Proceedings of the Large-Crystal Spectrometry Symposium. *J. G. Carver.* *U. S. Atomic Energy Commission, APEX-471*, Mar. 1959, 77 pp. (UF767 Un3.1ap Contin.)

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PLASTICS

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9695* The Physical Properties of Cross-Reinforced Plastics. The values for the modulus of elasticity, tensile strength, elongation at rupture and the Poisson's number of the base materials were computed for a composite material of glass fibers and polyester resin. (*In German.*) Die Festigkeitseigenschaften kreuzweise bewehrter Kunststoffe. ***Franz Beér.*** *VDI Zeitschrift*, v. 101, no. 12, Apr. 21, 1959, p. 463-468.

9696* Determination of the Softening Temperature of Polymer Films by Means of Measuring the Thermo-Mechanical Curves Under Uniaxial Stress. The apparatus described made it possible to study the thermo-mechanical properties of polymethyl acrylate, polystyrene, and styroflex. In connection with styroflex a marked difference was found between the thermo-mechanical curves of oriented and non-oriented materials. (*In Russian.*) Opredelenie temperatury razmiagcheniia polimerov putem sniatiia termomekhanicheskikh krivykh pri odnoosnom rastiazhenii. ***A. V. Sidorovich, V. S. Vashchenko, and E. V. Kuvshinskii.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 29, no. 4, Apr. 1959, p. 514-522.

See also: **8995** (Teflon insulation); **9207** (plastic tooling bibliography); **9236** (impregnated-plastic bearing); **9540** (radiation effects on plastics); **9725** (thermoplastics for ventilation equipment).

POLLUTION AND WASTES

9697* Topographic and Meteorological Factors Influencing Air Pollution in Cincinnati. ***Roy J. Shephard.*** *A.M.A. Archives of Industrial Health*, v. 19, no. 1, Jan. 1959, p. 44-54.

9698 Fifth Technical Progress Report. Air Pollution Foundation. Irradiation of automobile exhaust; photochemical reactions; exhaust control methods; and sulfur dioxide pollution. ***W. L. Faith, N. A. Renzetti, and L. H. Rogers.*** *Air Pollution Foundation, Report No.* 27, Mar. 1959, 77 pp. (TD884 Ai71.3r Vis.)

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9700 Air Pollution Abatement. Survey of current practices and costs. ***W. L. Faith.*** *Chemical Engineering Progress*, v. 55, Mar. 1959, p. 38-43.

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9702* Process for the Decontamination of Effluent. Requirements and properties for removal of radioactive constituents, including mechanical separation, chemical precipitation, evaporation and ion exchange. (*In German.*) Verfahren zur Dekontaminierung von Abwasser. ***G. Weiss.*** *Chemie-Ingenieur-Technik*, v. 31, Mar. 1959, p. 133-138.

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9704 Proceedings. National Conference on Air Pollution, Nov. 18-20, 1958. 526 pp. 1959. U. S. Government Printing Office, Washington 25, D. C. (TD884 N21.1p)

9705* Wastewater Technology in Germany. II. Recent developments. ***H. Rhode.*** *Water & Sewage Works*, v. 106, May 1959, p. 213-218.

9706* Elements of Sludge Digestion. ***A. Paul Troemper.*** *Water & Sewage Works*, v. 106, May 1959, p. 219-223.

See also: **8752** (refinery waste treatment); **8753** (liquid industrial waste control); **8997** (disposal of electroplating wastes); **9334** (dust control in foundries); **9539** (disposal of radioactive wastes).

RUBBER AND ELASTOMERS

9707 Natural and Synthetic Rubbers. Review article on test methods for natural and synthetic rubbers. ***Max Tryon and F. J. Linnig.*** *Analytical Chemistry*, v. 31, Apr. 1959, p. 767-776.

9708 Stress Relaxation During the Thermal Oxidation of Vulcanized Natural Rubber. Aging in the temperature range 80-100 C of natural rubber vulcanized by dicumyl peroxide, with a tetramethylthiuram disulfate recipe, a sulfenamide-sulfur recipe, and by sulfur alone has been investigated by the method of stress relaxation. ***J. R. Dunn, J. Scanlan, and W. F. Watson.*** *Faraday Society, Transactions*, v. 55, Apr. 1959, p. 667-675.

9709* Polymer Composition Versus Low-Temperature Characteristics of Polysiloxane Elastomers. Gehman cold-flex, volume-temperature, and stress-temperature studies were used to investigate the low-temperature characteristics of polysiloxane copolymers with respect to copolymer composition. Low-temperature characteristics of polysiloxane elastomers are explained. ***K. E. Polmanteer and M. J. Hunter.*** *Journal of Applied Polymer Science*, v. 1, no. 1, Jan.-Feb. 1959, p. 3-10.

9710* The Aging of Thiuram Disulfide Vulcanizates and Their Mechanism of Vulcanization. Aging studied by the stress-relaxation technique. the general behavior being independent of the nature of the alkyl group. ***J. R. Dunn and J. Scanlan.*** *Journal of Applied Polymer Science*, v. 1, no. 1, Jan.-Feb. 1959, p. 84-90.

9711* The Deformation of Foamed Elastic Materials. Theoretical treatment is given which predicts the behavior of a foamed elastic material on the basis of a model consisting of a network of thin threads. Basic concepts of the structure and mode of deformation. ***A. N. Gent and A. G. Thomas.*** *Journal of Applied Polymer Science*, v. 1, no. 1, Jan.-Feb. 1959, p. 107-113.

9712* Glass Formation in Polymers. II. The System Rubber-Sulfur. Volume versus temperature relations encompassing a wide range in temperature and composition have been determined for a series of natural rubber-sulfur vulcanizates and mixtures. ***Gordon M. Martin and Leo Mandelkern.*** *Journal of Research, National Bureau of Standards*, v. 62, no. 4, Apr. 1959, p. 141-146.

9713* Influence of Temperature on the Mechanical and Photoelastic Behavior of Elastomers. Temperature functions of the elasticity modulus and the photoelastic constant or its reciprocal value of various elastomers. Natural rubber is tested in various compounds. The effects of mastication, sulfur, and accelerator additions. vulcanization temperature and duration on the elasticity modulus, its reciprocal value, and the deviations from the ideal value are investigated. (*In German.*) Die Temperatur-Abhängigkeit des mechanischen und spannungsoptischen Verhaltens von Elastomeren. ***J. Kruse and T. Timm.*** *Kautschuk und Gummi*, v. 12, Apr. 1959, p. WT83-WT95.

9714* Modification of Rubber by Reaction With Maleic Anhydride. I. Reaction and Structure. ***Jean LeBras, Christian Pinazzi, and Gérard Milbert.*** *Revue Générale du Caoutchouc*, v. 36, Mar. 1959, p. 381-387.

9715* The Protection of Rubber Against Atmospheric Ozone-Cracking. Molecular mechanism of cracking, physical aspects of cracking, accelerated test apparatus, protective agents, and mechanism of action of antiozonants. ***B. S. Biggs.*** *Rubber Chemistry and Technology*, v. 31, no. 5, Dec. 1958, p. 1015-1034.

9716* Formulating a Castable Polyurethane. Using commercially available materials, a castable polyurethane elastomer can be formulated which has outstanding thermal-shock resistance. ***A. J. Quant.*** *SPE Journal*, v. 15, Apr. 1959, p. 298-302.

9717 New Silicone Rubbers Meet Tough DC-8 Specs. Report on a variety of new silicone rubber sealant compounds developed for the DC-8 and on their application. ***R. T. Daily and R. W. Scholler.*** *Space/Aeronautics*, v. 31, no. 5, May 1959, p. 85 + 3 pages.

9718 Synthetic Rubber: A Case Study in Technological Development Under Government Direction. Creation and development of the synthetic rubber industry. 130 pp. 1959. U. S. Government Printing Office, Washington, D. C. (TS1925 Un3.274s)

9719* Mechano-Chemical Phenomena in Polymers. II. The Effect of Initiators and Inhibitors of Radical Chain Processes. A significant effect has been shown of inhibitors and initiators of radical chain processes on the properties of raw rubbers during mastication and on the fatigue resistance of rubbers. (*In Russian.*) O mekhano-khimicheskikh iableniiakh v polimerakh. II. Vliianie initsiatorov i ingibitorov tsepnykh radikal'mykh protsessov. ***E. V. Reztsova, B. G. Lipkina, and G. L. Slonimskii.*** *Zhurnal Fizicheskoi Khimii*, v. 33, no. 3, Mar. 1959, p. 656-661.

See also: **9540** (radiation effects on elastomers); **9749** (elastomer-based adhesives).

SPACE HEATING AND CONDITIONING

9720 Solar Space Cooling. Design considerations and test results to provide a nominal cooling capacity during a normal eight-hour working day, using energy supplied by a solar source. ***R. Chung, G. O. G. Löf, and J. A. Duffie.*** *Chemical Engineering Progress*, v. 55, Apr. 1959, p. 74 + 3 pages.

9721 Ventilating the Shell Mold Foundry. Revamping ventilating equipment at Lynchburg Foundry Co. was made necessary by developments in shellmaking equipment. The author describes changes that have been made. ***William H. Puryear.*** *Foundry*, v. 87, May 1959, p. 88-91.

9722* Dust and Fume Problems in the Finishing Industry. ***J. B. Stribling.*** *Industrial Finishing (London)*, v. 2, Apr. 1959, p. 21-24.

9723* Air Conditioning Essential for Workers' Comfort, Product Quality. Complete air conditioning equipment must perform six functions: heating and humidification for winter, cooling and dehumidification for summer; and air filtering and proper ventilation the year round. ***F. C. Frean.*** *Industrial Finishing (London)*, v. 2, Apr. 1959, p. 25 + 2 pages.

9724* Air Conditioning, Dust and Fume Extraction. Techniques and services from the point of view of maintaining a healthy working atmosphere and as an essential for efficient production. *Industrial Finishing (London)*, v. 2, Apr. 1959, p. 28-29.

9725* Thermoplastics for Ventilation Equipment. ***H. P. Zade.*** *Industrial Finishing (London)*, v. 2, Apr. 1959, p. 30 + 1 page.

9726* The Choice of Heating and Ventilating Systems for Chemical Factories. The nature of the processes carried out in chemical factories makes stringent demands upon heating and ventilating systems. Describes installations which have proved their value in these conditions. ***J. E. Greatorex.*** *Manufacturing Chemist*, v. 30, Mar. 1959, p. 109-112.

TEXTILES, FIBERS, LEATHER, AND PAPER

9727* A Non-Destructive Method of Estimating Moisture in Wood. The method is based on the principle that a hygroscopic substance, such as wood, will eventually acquire equilibrium with any hygroscopic material in contact with it. If the material to be measured is wood, an estimate of its moisture content can be obtained by measuring the water in a wood probe with which it has reached equilibrium. ***D. E. Etheridge.*** *Canadian Journal of Botany*, v. 37, no. 3, May 1959, p. 491-492.

9728* Thermosetting, Exterior-Plywood Type Adhesives From Bark Extracts. Thermosetting resin adhesives for exterior plywood were developed by combining polyphenolic bark extracts with polymethylolphenol. This combination can be provided in a dry form or as a 40-45 per cent solids water solution that is quite stable at ordinary temperatures. ***F. W. Herrick and L. H. Bock.*** *Forest Products Journal*, v. 8, Oct. 1958, p. 269-274.

9729* Alcohol Production From Spent Sulfite Liquor. The process consists of recovery of spent sulfite liquor, steam stripping to recover sulfur dioxide, neutralizing with lime, continuous yeast fermentation, distilling the wort, and rectifying and purifying the alcohol. ***C. A. Watson.*** *Forest Products Journal*, v. 9, Mar. 1959, p. 25A-28A.

9730* Effect of Gamma Radiation on Ponderosa Pine: Hygroscopicity, Swelling, and Decay Susceptibility. Changes induced in the wood were small and not of practical importance. ***D. L. Kenaga and E. B. Cowling.*** *Forest Products Journal*, v. 9, Mar. 1959, p. 112-116.

9731* Fundamental Research in Wood Drying. ***R. L. Youngs.*** *Forest Products Journal*, v. 9, Mar. 1959, p. 121-124.

9732 Identification of Textile Materials. Includes natural and synthetic fibers. ***C. E. M. Jones, editor.*** 4th Rev. Ed., 148 pp. 1958. The Textile Institute, Manchester, England. (TS1449 T31i4)

9733* Effects on Fish and Wildlife of Chemical Treatments of Large Areas. Reviews the history of field investigations of the effects of DDT on wildlife from the initial studies in 1945 through the more recent studies of the effects of the large-scale programs for spruce-budworm control and gypsy-moth eradication. DDT dosages and procedures that are recommended for protection of wildlife are reviewed. Effects of aldrin, heptachlor, and toxaphene are discussed in connection with the grasshopper and Mormon cricket control programs. Delayed and indirect effects of chemical treatments are emphasized as an important current problem. Currently recommended procedures to safeguard wildlife in pesticidal programs are listed. ***John L. George.*** *Journal of Forestry*, v. 57, Apr. 1959, p. 250-254.

9734* What About Biological Control? Surveys biological-control work on forest insects and discusses possibilities for further investigations. ***Philip B. Dowden.*** *Journal of Forestry*, v. 57, Apr. 1959, p. 267-270.

9735* The Gypsy Moth Control Program. ***W. V. O'Dell.*** *Journal of Forestry*, v. 57, Apr. 1959, p. 271-273.

9736* Bark Beetle Control. ***Noel D. Wygant.*** *Journal of Forestry*, v. 57, Apr. 1959, p. 274-277.

9737* Systemics in the Control of Forest Insects. A review of the development and use of systemic insecticides. ***J. A. Rudinsky.*** *Journal of Forestry*, v. 57, Apr. 1959, p. 284-286.

9738* Color, Form, and Growth Variations in Eastern Redcedar. Trees grown from seed from eight widely separated sources exhibited wide genetic variations in color of winter foliage, crown form, growth rate, survival, leaf form, and resistance to cedar-apple rust. ***Leon S. Minckler and Russell A. Ryker.*** *Journal of Forestry*, v. 57, May 1959, p. 347-349.

9739* Maple Blight. A New Problem in the Lake States. ***Ralph L. Anderson.*** *Northeastern Logger*, v. 7, no. 11, May 1959, p. 28-29.

9740* A Panorama of the Residue Chip Recovery Program in the South. Utilization of wastewood chips in the South increased from its beginning in 1952 to 374,000 cords in 1955, then to 1.7 million cords in 1958. ***T. N. Baker.*** *Paper Trade Journal*, v. 143, Apr. 13, 1959, p. 40-43.

9741 Problems in Wood Chemistry. Contains lectures and discussions which took place during the meeting of the Panel of Experts on Wood Chemistry of FAO in Israel in April 1956. Subjects include radiation chemistry and wood; chemistry, morphology and mechanical properties of the compound middle lamella; carbohydrate lignin bonding in wood; and resin for wood adhesives. ***H. Mark, et al.*** 136 pp. 1957. The Weizmann Science Press of Israel, Jerusalem. (TA419 F73p)

9742* Co-Ordinating Forest Genetics Programs in the United States. Describes the types of activity which are going on in forest genetics and forest tree improvement programs in the United States today. ***Philip N. Joranson.*** *Pulp and Paper Magazine of Canada*, v. 60, Apr. 1959, p. 154 + 3 pages.

9743* New Population Trends and Wood Use. Projects economic activity and raw material requirements into next decade, discusses what prospective economic growth might mean to the forest industries, and appraises the ability of U. S. forests to supply potential timber demands. ***H. R. Josephson.*** *Southern Pulp and Paper Manufacturer*, v. 22, Apr. 1959, p. 112 + 4 pages.

9744* Attempts to Decrease the Formation of Pitch During Distillation of Crude Tall Oil. Distillates of over 90% may be obtained by flash distillation at about 5 mm. pressure under superheating in a still made of stainless steel. ***Terje Enkvist.*** *Svensk Papperstidning*, v. 62, no. 6, Mar. 31, 1959, p. 183-186.

9745* The Utilization of Bark. ***J. E. Marian and A. Wising.*** *Svensk Papperstidning*, v. 62, no. 6, Mar. 31, 1959, p. 187-193.

9746* Classification of Pulps According to Supermolecular Structure of Cellulose. ***L. R. Parks.*** *Tappi*, v. 42, Apr. 1959, p. 317-319.

See also: **8629** (plant viruses in tissue culture); **9048** (forestry economics); **9084** (flow of pulp suspensions).

WELDING AND JOINING

9747 Roll-Welded Panels. Production of hydraulically-expanded tubes in roll-welded-panels. *Aircraft Production*, v. 21, May 1959, p. 176.

9748 New Dip Transfer Welding Process. The Dip Transfer Process is a new and practical method of welding mild steel and low alloy steel in an atmosphere of inert gas. With Dip Transfer, metal is transferred by a wiping action at the time of short circuit, rather than being projected through an arc stream as in conventional methods. *Automotive Industries*, v. 120, no. 9, May 1, 1959, p. 39.

9749* The Technology of Commercial Elastomer-Based Adhesives. A study of adhesives, historical background and present needs; their two types, respectively based on solutions in organic solvent and on aqueous emulsions, their structure, the properties of rubber based adhesives, solubility of some elastomers in different solvents, the stabilizers, catalysts and fillers; the uses of both types of adhesives. (*In German.*) Die Technologie industrieller Kleber auf Elastomerbasis. ***J. Szurrat.*** *Bitumen, Teere, Asphalte, Peche*, v. 10, no. 3, Mar. 1959, p. 102-106.

9750 Flange Deformations in the Welding of T-Sections. The author has studied the general nature of the bending of flange plates in T and H sections, and has developed formulae for the determination of such deformation, based on the known welding conditions. ***N. O. Okerblom.*** *British Welding Journal*, v. 6, Apr. 1959, p. 145-154.

9751 Effect of Storage Time on the Hydrogen Content and Mechanical Properties of Arc Welds Made With Covered Electrodes. ***W. Hummitsch.*** *British Welding Journal*, v. 6, Apr. 1959, p. 155-160.

9752 Welding and the Nuclear Power Programme. Reactors to date have not called for any basically new material but demand higher standards of existing materials and practices. With the Advanced Gas-Cooled Reactor and the Fast Fission Breeder, novel materials are introduced accompanied by major processing and joining difficulties. ***Leonard Owen.*** *British Welding Journal*, v. 6, May 1959, p. 197-204.

9753 Welding From the Viewpoint of Lloyd's Register of Shipping. The paper is a historical survey of the attitude of the Society towards welding during the past fifty years. ***G. M. Boyd.*** *British Welding Journal*, v. 6, May 1959, p. 205-210.

9754 Phase Analysis of Resistance Welded Joints in Unalloyed and Low-Alloy Carbon Steels. By the use of electron microscope techniques a study has been made of the structure of welded joints made by the resistance welding process. Materials used ranged from low-carbon steel to duplex joints in high-carbon and austenitic stainless steels. The different structures obtained are illustrated in a series of microphotographs. ***D. Hrivňák and I. Hrivňák.*** *British Welding Journal*, v. 6, May 1959, p. 229-237.

9755 Design and Application of Flash Butt-Welded Rings. Several major advantages can be gained by specifying flash butt-welded rings for applications requiring circular components. Flash-weldable alloys; martensitic and austenitic age-hardenable alloys; medium tensile strength, low-alloy materials; commercially pure Ti and Ti alloys; high tensile-strength, low-alloy materials; austenitic and ferritic nonhardenable alloys; Al alloys; Mg, Zr, and Cu-base alloys. ***Forrest W. Johnson.*** *Machine Design*, v. 31, Apr. 30, 1959, p. 123-126.

9756 Experimental Ultrasonic Seam Welding Equipment. The "electrode" spindles are connected to transducers whereby they are vibrated axially at a frequency of 20,000 cycles per sec. During tests, two pieces of 0·01-in. thick aluminium were seam welded at a speed of 15 in. per min. Other metals that can be welded in this manner include steel, copper, and silver, and the process permits joints between dissimilar metals. *Machinery (London)*, v. 94, Apr. 8, 1959, p. 774.

9757 The Quantity Production of Accurate Welded Wire Components. *Machinery (London)*, v. 94, Apr. 15, 1959, p. 816-827.

9758 Spot-Welded Corrugated Sandwich Construction for Aircraft. Methods and Equipment Employed by Handley Page, Ltd. *Machinery (London)*, v. 94, Apr. 22, 1959, p. 876-888.

9759 Water Heater Tank Line Features Automatic Welding. At Republic-Odin one specialized spud welder is used for welding the spuds in the top of the tank, and another is used for welding the spuds in the tank sides. Both machines employ automatic submerged arc welding heads mounted on rotating beams which complete the weld around a spud in a single-pass revolution. Leakage rejects are almost nil. *Metal Products Manufacturing*, v. 16, May 1959, p. 30 + 2 pages.

9760 What Next for Resistance Welding? Hard-to-weld metals, thicker and thinner sections, ultrahigh quality welds, detailed process data—these are a few of the things on which Sciaky's Research Division is focusing its attention. *Modern Assembly Practice*, 1959, Mar.-Apr., p. 15-16.

9761 New Welding Process Speeds Truck Body Assembly. Anthony Company gets 50% greater weld metal deposition per hour over stick electrodes on its small body line with new automatic CO_2 welding process developed by National Cylinder Gas Co. *Modern Assembly Practice*, 1959, Mar.-Apr., p. 17-18.

9762* New Developments in Adhesives for Plastics. ***Bernard Gould.*** *Plastics Industry*, v. 17, Apr. 1959, p. 22-23.

9763 New Honeycomb Brazing Meets Quadrupled Needs. Discusses latest results obtained by North American Aviation, Inc. *Product Engineering*, v. 30, no. 17, Apr. 27, 1959, p. 23-24.

9764 Adhesives Do a Better Job of Bonding Lamination Stacks. ***Russell E. George.*** *Product Engineering*, v. 30, no. 17, Apr. 27, 1959, p. 63.

9765 Recent Developments in Brazing Hard Alloy Tips. Deals with the results of the recent research works aimed at the improvement of brazing technology applied to tip tools. Having discussed specific conditions which must be taken into consideration with brazed tip tools, the author explains main causes of tensions in the tool and suggests a method for calculating them. Experimental methods for measuring tension are described and suggestions are given, how to eliminate excessive stress. (*In Czech.*) Nove poznatky v technologii pájení nástrojů se slinutým karbidem. ***J. Houdek.*** *Strojírenství*, v. 9, no. 3, Mar. 1959, p. 212-219.

9766* Some Metallurgical Points of View About Steel for Welded Structures. The selecting of different types of steel on the basis of tests concerning the strain concentration, the rate of deformation and the prevailing temperature and weldability as a function of analysis were studied with some excerpts of the standard specifications. (*In Norwegian.*) Noen metallurgiske synspunkter på stål for sveisede konstruksjoner. ***Erling Braaten.*** *Teknisk Ukeblad*, v. 106, no. 16, Apr. 16, 1959, p. 325-330.

9767 Bonding of Various Metals and Alloys by Isostatic Pressing at Elevated Temperatures. By installing a Kanthal furnace inside the pressure vessel, in place of the external heating mantle, the operating temperature of the vessel was increased from 570 C to 1200 C. This higher operating temperature enabled the successful hot isostatic bonding of various materials such as "Zircaloy-2" to 8 w/o U-Zr; "Zircaloy-2" to 10 w/o Nb-U; "Nichrome" to 35 w/o UO_2-Nb; 40 w/o Ti-Nb to 30 w/o UO_2-Nb; and Al to 20 w/o U-Al. ***J. Fugardi and J. L. Zambrow.*** *U. S. Atomic Energy Commission, SCNC-272*, Dec. 1958, 37 pp. (UF767 Un3.1scn Contin.)

9768 Factors in the Selection of Welding Processes. In the selection of the most suitable welding process, it is important to first give consideration to the service requirements and engineering design and then to select a design for the particular process which will result in the most economical welding cost. ***John J. Chyle.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 9-38. (T21 Un3r Contin.)

9769 Survey of Welding Codes; Standards and Specifications for Welding. Testing must be related to the service conditions, and under some conditions the elaborate forms that are currently used may be eliminated. ***Arthur Kugler.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 39-46. (T21 Un3r Contin.)

9770 Research Destructive Test Methods for Weldability. From the standpoint of weldability evaluation, it is not so much a matter of great concern that a wide variety of test methods be available for random coverage of the problem, but rather that tests for properties pertinent to the job involved be used and a better understanding be obtained of their significance with regard to service performance. ***William L. Warner.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 59-90. (T21 Un3r Contin.)

9771 Sampling and Proof Testing for Weld Acceptance. There are some standard tests that can be used on certain products but very often the proof testing must be tailored to fit the need and also the cost of a product. For many properties and combinations of properties, there are no practical proof tests. In these cases, the best that can be done is to rely upon nondestructive testing or random sampling and destructive testing. ***P. J. Rieppel.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 91-95. (T21 Un3r Contin.)

9772 Storage and Pressure Vessels. Three major groups of storage vessels are considered. First and most numerous are the vessels used to store water, petroleum products, chemicals, and other materials. The second group includes low-pressure vessels designed to store volatile liquid products with a superimposed gas pressure up to about 30 psig. The third group includes the vessels commonly referred to as pressure vessels which are designed for liquid and gas storage with gas pressure in excess of 30 psig. ***Fred L. Plummer.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 99-117. (T21 Un3r Contin.)

9773 Welded Bridges. The subject is presented from the viewpoint of a railroad bridge engineer, and the paper describes all-welded railroad-bridge design and construction as well as the use of welding in repairing, strengthening, and altering existing riveted railroad bridges. ***J. E. South.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 119-138. (T21 Un3r Contin.)

9774 Ship Structure. This description is confined to the welding of ships' hulls. ***E. M. MacCutcheon.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 139-146. (T21 Un3r Contin.)

9775 Design of Hydraulic Structures. Structures to be described and illustrated in this paper consist chiefly of gates, penstocks, and surge tanks. ***R. P. Hobson.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 147-160. (T21 Un3r Contin.)

9776 Engineering Aspects of Welding and Arc Cutting the Aluminum Alloys. There have been new developments in weldable Al alloys with the introduction of additional Al-Mg alloys. This paper is a progress report on research and development with these alloys. ***P. B. Dickerson.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 165-178. (T21 Un3r Contin.)

9777 Hard-Facing. Discusses the process, equipment, and applications. ***R. T. Phillips.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 179-202. (T21 Un3r Contin.)

9778 Surfacing by the Thermo Spray Process. ***Sam Tour.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 203-212. (T21 Un3r Contin.)

9779 Welding of the Army Package Power Reactor. Welding applications in the APPR-1 are described. ***R. D. Robertson.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 213-234. (T21 Un3r Contin.)

9780 Research and Experience in Welded Steel Construction. Discusses need for careful discrimination in analyzing and interpreting research and experience—also in applying what has been learned from these sources. ***LaMotte Grover.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 235-243. (T21 Un3r Contin.)

9781 The Evaluation of Laboratory Fatigue Studies of Welded Structures. It is hoped that this discussion of the manner in which the laboratory results have been and are being used effectively to provide for the design of welded bridges will help to alleviate the fears sometimes expressed over the use of welding for structures subjected to repeated loads and to show how the laboratory can properly be used to predict the behavior of these structures. ***W. H. Munse.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 245-259. (T21 Un3r Contin.)

9782 European Welding Operations. Considers the welding processes that are being used and the applications in which welding is being used, and compares the place that welding has taken in the life of European people with that in America. ***Clarence E. Jackson.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 265-279. (T21 Un3r Contin.)

9783 The Use of Steel Castings in Engineering Weldments. To design a casting or a plate weldment into a composite, disregarding the rules of the foundry, invites defects and necessitates higher cost in most instances. When the designer works closely with the foundry, savings can be effected in the production of composite weldments. ***N. N. Breyer.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 281-293. (T21 Un3r Contin.)

9784 The Army Conservation-of-Materials Program and Some Conservation Measures Accomplished by Welding. This paper is intended to show the need for a materials conservation program. It will also discuss the aims of the program. It will cover how the Army Conservation program functions, how manufacturers may help, and finally, some of the ways welding has supported the program. ***William B. Spangler.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 307-318. (T21 Un3r Contin.)

9785 A New Concept of Welded Design for Improved Vibration Control. Efficiently designed welded steel has superior properties for coping with vibration problems found in many types of machine tools. New ideas about vibration and its control through the use of welded steel have come out of recent research. This paper discusses some of these ideas. ***Omer Blodgett.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 319-334. (T21 Un3r Contin.)

9786 Effect of Welding on the Notch Toughness of a Casualty Material (280MM Carriage Rear Float Bolster). To assure that the toughness of the base metal is not nullified by a notch-sensitive weld heat-affected zone, a "weldability" test which will permit evaluation of the relative toughness of the weld heat-affected zone and base metal should be incorporated in the specification for steels which are to be used in critical service applications. ***William P. Hatch, Jr. and Carl E. Hartbower.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 361-373. (T21 Un3r Contin.)

9787 The Fusion Zone as a Major Weldability Concept in Welding of High Strength Steels. Introduction of multiple-alloy high-strength steels has created a necessity for expansion of the weldability theory. It is concluded from evidence contained herein that a basis for continued research in the phenomenon of the fusion zone is justified. ***Julian S. Kobler.*** *U. S. Office of Technical Services, PB* 131739, 1957, p. 381-398. (T21 Un3r Contin.)

9788 Automatic Welding in the Shipyards. The influence of recent developments on the potential volume of automatic welding in the shipyards. ***P. Shaw.*** *Welding and Metal Fabrication*, v. 27, Apr. 1959, p. 128-134.

9789 Welding the Victor V-Bomber. Reasons for introducing sandwich construction; surface preparation of material for spot welding; re-assembly prior to spot welding; principles of operation—three-phase modu-wave machines. ***C. A. Burton and H. Tyte.*** *Welding and Metal Fabrication*, v. 27, Apr. 1959, p. 135 + 7 pages.

9790 Enter: Welding Exit: Hard Water. Water-softening machines owe much of their efficiency to welding. *Welding Engineer*, v. 44, May 1959, p. 38-39.

9791 New System Eliminates CO_2 Disadvantages. Termed "dip transfer", the method's principle is the transfer of weld metal by a wiping action at the time of short circuit. According to the company, this pulsing arc (up to 200 contacts per second) will reduce inherent disadvantages of CO_2 welding on mild and low-alloy steels. *Welding Engineer*, v. 44, May 1959, p. 46.

9792 For Mig Welding, Extruded Uranium Welding Wire Proves Best. ***E. L. Brundige, G. S. Hanks, and J. M. Taub.*** *Welding Engineer*, v. 44, May 1959, p. 58.

9793* Development in the Production of Filler Materials for Arc Welding, in Vamberk for the Last 20 Years. This is the introductory paper to the third "Day of Welding Technics" held by the Electrode Producting Shop of the A. Zápotocký Ironworks on October 16-17, 1958. The report describes strictly the state of production of filler materials for arc welding and the progress realized during the last years. (*In Czech.*) Rozvoj výroby přídavných materiálů pro svařování elektrickým obloukem ve Vamberku za 20 let. ***Antonín Kleander.*** *Zvaranie*, v. 8, no. 3, Mar. 1959, p. 65-70.

9794* Electrodes and the Development of Welded Structures. Describes the beginnings of arc welding. (*In Czech.*) Elektrody a vývoj svařovaných konstrukci. ***František Faltus.*** *Zvaranie*, v. 8, no. 3, Mar. 1959, p. 71-73.

9795* New Austenitic Electrodes VUS-EA 3 for High Pressure Power Engineering. Development of a new electrode and the respective problems in the range of materials for high steam parameters, as well as the difficulties to overcome in the development. Effect of the chemical composition of the weld metal on the quality and mechanical properties of electrodes containing 25% Cr-20% Ni. Effect of chemical composition on quality and mechanical properties of weld metal using E-385 electrodes. (*In Czech.*) Nová austenitická elektróda VUS-EA 3 pre vysokoparametrovú energetiku. ***Štefan Horváth.*** *Zvaranie*, v. 8, no. 3, Mar. 1959, p. 78-85.

9796* Under Flux Welding of Steels 13 123. To ensure the production of large-sized welded drums, the Vitkovic Ironworks of Klement Gottwald in Ostrava has solved the technology of Manual Arc Welding, Automatic and Electroslag-welding of Steels 13 123 to a thickness of 120 mm. (*In Czech.*) Svařování oceli 13 123 pod tavidlem. ***Hajzler Výzkg.*** *Zvaranie*, v. 8, no. 3, Mar. 1959, p. 92-96.

See also: **8889** (resorcinol adhesives); **9242** (British welding exhibition); **9248** (welding cast alloy steel); **9276** (Si in spotwelding electrodes); **9298** (corrosion of stainless steel welds); **9373** (hardening of welds); **9386** (notch ductility of mild-steel weld metal); **9387** (mechanical properties of welds in galvanized steel); **9687** (joining plastic pipe).

MISCELLANEOUS

9797* Silicosis in the Foundry—Medical Control. Silicosis in foundry workers may show variable disease patterns resulting from differences in exposure to silica dust according to occupation. Chipping has been the most hazardous occupation, and the pattern of the disease among chippers may differ notably from the pattern of the disease among other foundry workers. ***W. Burton Ayre.*** *A.M.A. Archives of Industrial Health*, v. 19, no. 5, May 1959, p. 490-496.

9798* The Biological Effects of Vanadium. II. The Signs and Symptoms of Occupational Vanadium Exposure. Twenty-four vanadium workers were studied. A detailed history and physical examination, urinalysis, hematocrit, electrocardiogram, urine for vanadium content, and serum cholesterol determination were done on these men and on a larger group of controls. No evidence was found of chronic intoxication or injury attributable to vanadium exposure. ***Charles E. Lewis.*** *A.M.A. Archives of Industrial Health*, v. 19, no. 5, May 1959, p. 497-503.

9799* The Industrial Hygiene of Uranium Fabrication. During the course of the development of procedures for the production of uranium fuel elements, substantially all metallurgical and metal fabricating techniques have been attempted. Most of these techniques have been studied, including rolling, hammer and press forging, extrusion, drawing, swaging, powder processing, machining, and grinding. The experience gained from these various operations is summarized in terms of airborne occupational exposures. ***William B. Harris and Irving Kingsley.*** *A.M.A. Archives of Industrial Health*, v. 19, no. 5, May 1959, p. 540-565.

9800* Starting Your Own Consulting Office. The author gives a very practical view of the benefits and drawbacks of being a consultant. ***Robert H. Emerick.*** *American Engineer*, v. 29, May 1959, p. 23 + 4 pages.

9801* Why Engineers Change Jobs in Industry. Some 60,000 engineers change jobs every year. The author attempts to explain this phenomenon and to suggest possible remedies. ***Joseph Alcabes.*** *American Engineer*, v. 29, May 1959, p. 32-34.

9802 Reviewing a New Summary of Fee Schedules and Manuals of Practice as Now in Use. Fee schedules or manuals of practice published by twenty-five state societies of professional engineers have been reviewed by a task force of the NSPE Functional Section for Consulting Engineers, and a summary report is now being published by the Society. It is intended to be of service as a reference for use by committees engaged in preparing or revising these state society publications, and it may also be useful to consulting engineers with practice extending into several states. ***Frank E. Sanford.*** *American Engineer*, v. 29, May 1959, p. 35-37.

9803* Further Evidence of One-Trial Associative Learning. Four experiments were performed to investigate possible objections to the results previously reported that associations are formed in one trial. The four new experiments were interpreted as supporting the conclusion that in rote-learning associations are formed on one trial and not by a process of gradual strengthening. ***Irvin Rock and Walter Heimer.*** *American Journal of Psychology*, v. 72, no. 1, Mar. 1959, p. 1-16.

9804* The Formation of Concepts With Non-Verbal Auditory Stimuli. This study attempts to extend the experiments on concept-formation into the auditory field and to test hypotheses arising from the experiment as a model for learning-theory. ***Fred L. Royer.*** *American Journal of Psychology*, v. 72, no. 1, Mar. 1959, p. 17-31.

9805* Linguistic Manifestations of Bilingualism. The closer an individual approaches bilingual balance, the more he will be able to perceive and read words in both languages with similar speeds, to associate in both languages with similar fluency, to make active use of his vocabularies in both languages, and to be set to verbalize in both languages. ***W. E. Lambert, J. Havelka, and R. C. Gardner.*** *American Journal of Psychology*, v. 72, no. 1, Mar. 1959, p. 77-82.

9806* Science and Ethical Behavior. ***Nicholas Hobbs.*** *American Psychologist*, v. 14, May 1959, p. 217-225.

9807* The Use of the Same Experimental Material for More Than One Set of Treatments. Experimental material sometimes has to be used successively for more than one set of treatments. Various ways of doing this are considered in this paper, distinguishing between cases with and without interactions of two sets of treatments. ***G. H. Freeman.*** *Applied Statistics*, v. 8, no. 1, Mar. 1959, p. 13-20.

9808* Dust in the Ironfoundry. Summarizes the available background knowledge relating to pneumoconiosis as it occurs in the ironfounding industry. The main sources of dust in the ironfoundry are stated; the causation of pneumoconiosis and its progress are also summarized. Outlines the main systems of control which are available and indicates the control methods which are most suitable in the various foundry operations for four main types of foundries. ***H. T. Angus and W. B. Parkes.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 10, Feb. 1959, p. 624-636.

9809 Screening Out the Misfits. Columbia University's study of Army experience draws conclusions applicable to industrial management. *Business Week*, no. 1549, May 9, 1959, p. 82.

9810* Homology and Ringoids. II. ***P. J. Hilton and W. Ledermann.*** *Cambridge Philosophical Society, Proceedings*, v. 55, pt. 2, Apr. 1959, p. 149-164.

9811* Generalized Intervals in Partially Ordered Groups. The present paper is chiefly concerned with a generalization, to be known as a "D-interval", of the notion of interval or segment in an arbitrary partially ordered group. ***D. C. J. Burgess.*** *Cambridge Philosophical Society, Proceedings*, v. 55, pt. 2, Apr. 1959, p. 165-171.

9812* Diffraction by an Imperfectly Conducting Right-Angled Wedge. A new and exact solution is given for the diffraction of the field of an electric line current by an imperfectly conducting wedge of exterior angle $\frac{3}{2}\pi$. ***W. E. Williams.*** *Cambridge Philosophical Society, Proceedings*, v. 55, pt. 2, Apr. 1959, p. 195-209.

9813 Statistics in the Strategy of Chemical Experimentation. To obtain effective prediction from chemical experimentation, full use should be made of modern statistical methods to complement, not replace, engineering and chemical principles. ***S. L. Andersen.*** *Chemical Engineering Progress*, v. 55, Apr. 1959, p. 61-67.

9814* The Progress of Science in Israel. The communication of science, the appreciation of the power of the scientific method at the highest political level, the imaginative use of scientific results, and a scientific planning for the future, are problems of world-wide importance; Israel may well claim to be the pilot plant for this new scientific world. So far, great results have been achieved of which all Israelis are justly proud, but much remains to be done before the preliminary results of a pilot-plant experiment can be applied to full-scale use by the rest of the new world. *Discovery*, v. 20, May 1959, p. 183-196.

9815 Top Scientists Look 10 Years Ahead. Sixteen of the world's most distinguished scientists see much faster product and equipment obsolescence, industrial growth dominated by electronics, enormously expanded uses of plastics, and industrial materials designed to order in the next ten years. *Dun's Review and Modern Industry*, v. 73, no. 5, May 1959, p. 56-58.

9816* Symbols and Self-Preservation. For human beings, the proverbial "instinct" of self-preservation at least partly inclines to become the preservation of certain symbolic assertions

about one's self. These assertions tend to take the form of messages which are sent out to society, reinforced by whatever behavior makes the message more convincing. The results of the message become the main test of its validity. ***Richard Dettering.*** *ETC. A Review of General Semantics*, v. 16, no. 2, Winter 1959, p. 174-184.

9817 Research and Development Cost Estimation. Four companies engaged in research and development were interviewed relative to their method of cost prediction. ***Vernon L. Lambert and Hubert F. Sackett.*** *IRE Transactions on Engineering Management*, v. EM-6, no. 1, Mar. 1959, p. 8-12. (TK1 In6.6em Vis.)

9818 Industry-University Cooperation in the Field of Research. ***Ralph I. Cole.*** *IRE Transactions on Engineering Management*, v. EM-6, no. 1, Mar. 1959, p. 12-13. (TK1 In6.6em Vis.)

9819 Why Isn't the Post Office Automated? A postal official reviews several plans of post office automation, describes various automatic machines now under development, and compares the present American system with those of other countries. ***Edson O. Sessions.*** *Industrial Research*, v. 1, no. 1, Jan. 1959, p. 56-61.

9820 Automata. Discusses recent work on mechanically simulating the activity of the brain. ***Neil P. Ruzic, editor.*** *Industrial Research*, v. 1, no. 2, Spring 1959, p. 47-59.

9821* The Truth Shall Make You Free. This speech, given at the Polytechnic Institute of Brooklyn, Brooklyn, N. Y., on April 19, 1958, is a resumé of the author's evaluation of the American system of education. ***H. G. Rickover.*** *Journal of Engineering Education*, v. 49, no. 8, Apr. 1959, p. 651-660.

9822* Internal Obligations of the Universities in Maintaining Stability of Research Programs in the Engineering College. ***Raymond L. Chuan.*** *Journal of Engineering Education*, v. 49, no. 8, Apr. 1959, p. 666-671.

9823* On the Equation of the Vibrating String. ***William Feller.*** *Journal of Mathematics and Mechanics*, v. 8, no. 3, May 1959, p. 339-348.

9824 Research and Development Proposals. What engineers should know about contract bids on engineering and scientific projects for the government. ***John V. E. Hansen.*** *Machine Design*, v. 31, Apr. 16, 1959, p. 134-139.

9825* Industrial Trucks of the Future. The lift truck of the future will have no operator. Punch cards or magnetic tapes will direct operations. A handling supervisor will insert prerecorded instructions into a slot in the truck. A day's work will be done without further supervision. *Material Handling Engineering*, v. 14, no. 8, May 1959, p. 72-74.

9826* Selection and Use of Vibrating Conveyors. Toughness and versatility are outstanding features of vibrating conveyors. *Material Handling Engineering*, v. 14, no. 8, May 1959, p. 76 + 5 pages.

9827* The Dynamics of Packaging. Package designers should understand the dynamics of packages in motion before they undertake to design a package that will travel safely. ***James H. Greene and James A. Collier.*** *Material Handling Engineering*, v. 14, no. 8, May 1959, p. 96 + 3 pages.

9828* Finding and Developing Technical Personnel. Here are the methods by which modern industry seeks and cultivates its high-potential manpower. ***R. G. Alleman and W. E. Alexander.*** *Mechanical Engineering*, v. 81, Apr. 1959, p. 65-68.

9829* Problems in Maxima and Minima. The useful application of differential calculus to the determination of maxima and minima is well known to engineers, but it is not usually appreciated that partial differentiation considerably shortens calculation. The method is discussed in relation to engineering practice. ***W. H. Sheppard.*** *Mechanical World and Engineering Record*, v. 139, Apr. 1959, p. 170-173.

9830 The Dollar Bill Changer. Unit fills need for quickly making change at point of purchase, and is the result of two years of development and field testing. *Metal Products Manufacturing*, v. 16, May 1959, p. V26.

9831* Symposium on Science in Society. Titles of the four papers included are: "Science in Society"; "Some Reflections on the State of Science in America During the Nineteenth Century"; "Science in the French Revolution"; and "Society, Science, and Education in the Soviet Union". ***H. L. Shapiro, I. Bernard Cohen, Charles C. Gillispie, and Chauncy D. Harris.*** *National Academy of Sciences, Proceedings*, v. 45, May 1959, p. 661-692.

9832 Numerical Integration Works With Dynamic Systems Too. Numerical integration is so easily applied to solving any ordinary differential equation that there is no need for advanced training. Fairly accurate results can be obtained without much work. Two examples—oscillations of a mass-spring system, and flight analysis of a rocket—illustrate this method. ***Eric E. Ungar.*** *Product Engineering*, v. 30, no. 17, Apr. 27, 1959, p. 64-66.

9833 Public Interest in Science News. Two surveys show a direct relationship between science education and assimilation of the news. ***Hiller Krieghbaum.*** *Science*, v. 129, Apr. 24, 1959, p. 1092-1095.

9834 American Science Between 1780 and 1830. The exploration and industrialization of the new nation led to advances in natural science and technology. ***D. J. Struik.*** *Science*, v. 129, Apr. 24, 1959, p. 1100-1106.

9835 Scientific Manpower in Europe. Discusses the status and future of the scientist in government; the recruitment and retention of scientists for the public service; concepts, policies, and practices on determination of pay for scientists; the higher education of engineers; the organization of science; and a comparison of major personnel practices in Russia and the United States of America, among other topics. ***Edward McCrensky.*** 188 pp. 1958. Pergamon Press, New York. (Q127.E8 M13s)

9836 Surveys in Applied Mathematics. v. II. Dynamics and Nonlinear Mechanics. Some recent advances in the dynamics of rigid bodies and celestial mechanics. Outlines the current state-of-the-art in the analysis of nonlinear oscillating systems and points the way to future developments. ***E. Leimanis and N. Minorsky.*** 206 pp. 1958. John Wiley & Sons, New York. (QA845 L53d)

9837* What Management Expects of Research and Members of Its Research Staff. Discusses industrial research in general and paper research in particular. ***A. B. Layton.*** *Tappi*, v. 42, Mar. 1959, p. 52A + 3 pages.

9838 The Processes of Creative Thinking. The authors conclude there is no need for a theory of creative thinking distinct from a theory of problem solving. They summarize what has been learned about problem solving by simulating human problem-solving processes with digital computers, and then point out differences in degree observed in comparing relatively creative with relatively routine problem solving. ***A. Newell, J. C. Shaw, and H. A. Simon.*** *Rand Corporation, Report P-1320*, (Rev.), Jan. 28, 1959, 82 pp. (T13 R15r Contin.)

9839 Scientific Research and Development in Colleges and Universities. Expenditures and Manpower—1953-54. Although this report is confined to funds for scientific research and development and to scientific manpower, it may shed light not only on some specific problems but also on the broader aspects of the Government's needs in this area and the Nation's educational strength. 173 pp. 1958. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (Q180.U5 N21sr)

9840 Table of the Fresnel Integral to Six Decimal Places. The Fresnel integral is of frequent occurrence in theoretical physics and, in particular, in applications of the theory of diffraction. The present table is intended to assist in computations associated with this type of calculation, particularly where reference must be made for many values. ***T. Pearcey, compiler.*** 63 pp. 1956. Cambridge University Press, London. (QA310 P31t)

9841* The Role of the Research Administrator. This paper is divided into three sections. The first discusses varying definitions of the job of the research administrator, sources of recruitment for the position, and place of the administrator in the formal hierarchy. The second section discusses the role of the administrator in the context of the goals of the research organization and of the scientists who work in it. The third section deals with selected aspects of the role which seem to be of special importance. ***Norman Kaplan.*** *Administrative Science Quarterly*, v. 4, no. 1, June 1959, p. 20-42.

9842 The Airy Integral, Giving Tables of Solutions of the Differential Equation $y'' = xy$. *J. C. P. Miller.* v. B. 56 pp. 1946. Cambridge University Press, London. (QA47 B77m Over.)

9843* Is U.S. Productivity Misdirected? A brief summary of views expressed at the ASME's National Production Engineering Conference held in May 1959. *American Machinist*, v. 103, June 1, 1959, p. 95.

9844* The Dirac Measure as Applied to the Solution of Difference Equations by Means of Transforms. It is known that transforms (Laplace, Fourier, etc.) can be used to solve difference equations. In this note it is shown that by aid of the Dirac measure of L. Schwartz (in essence the integral of Stieltjes) one can obtain the solution of linear difference equations. ***Harry Lass and Oldwig Von Roos.*** *American Mathematical Monthly*, v. 66, no. 6, June-July 1959, p. 483-488.

9845 Special Overhead Conveyors for Small Parts Assembly at Cadillac. With the start of 1959 production, Cadillac put into operation three different closed loop overhead conveyor assembly lines—one for the lower instrument panel group; one for the upper instrument panel group; and a third conveyor for the assembly of front and rear bumpers. ***Joseph Geschelin.*** *Automotive Industries*, v. 120, no. 11, June 1, 1959, p. 36-38.

9846 British Association Mathematical Tables. v. X. Bessel Functions. Pt. II. Functions of Positive Integer Order. The tables fall into two main groups. The first group, Tables I-IV, aims at providing 8-figure (in the case of $J_n(X)$, 8-decimal) values of the function with provision for interpolation. The second group, Tables V-VIII, gives 10-figure (in the case of $J_n(X)$, 10-decimal) values of the function at a uniform interval of 0·1 in x, with no special provision for interpolation. ***W. G. Bickley, L. J. Comrie, D. H. Sadler, J. C. P. Miller, and A. J. Thompson.*** 255 pp. 1952. Cambridge University Press, London. (QA47 B77m Over.)

9847 Why Outer Space Control? Discusses several long-range objectives in the area of arms limitation and control that could be served by certain agreements on space control. ***D. G. Brennan.*** *Bulletin of the Atomic Scientists*, v. 15, no. 5, May 1959, p. 198-202.

9848 Caverns of West Virginia. Describes some 400 caves and includes maps of the more important ones. ***William E. Davies.*** v. XIX (A). 330 pp. 1958. State of West Virginia, Geological and Economic Survey Commission, Charleston, W. Va. (QE177 W52.3w Vis.)

9849 Complex Variable Theory and Transform Calculus With Technical Applications. This is the second edition of the book first published in 1939. The author, writing primarily for technologists, has made a complete revision of the text, deleting many of the old sections and adding new ones. ***N. W. McLachlan.*** 2nd Ed. 388 pp. 1955. Cambridge University Press, London. (QA432 M22c2)

9850 Conformal Representation. *C. Carathéodory.* 2nd Ed. 115 pp. 1958. Cambridge University Press, London. (QA360 C17c2)

9851 Education and Freedom. In this book, Admiral Rickover points up the need of better schooling for all our children—education far superior to anything we in this country have ever had or ever needed in the past. He states that only massive upgrading of the scholastic standards of our schools will guarantee the future prosperity and freedom of the Republic. ***H. G. Rickover.*** 256 pp. 1959. E. P. Dutton & Co., New York. (LA209.2 R42e)

9852 Engineering Manpower: How to Improve Its Productivity. Describes the philosophy, policies, and practices of American industrial concerns toward their nonscientific technical personnel. ***George A. von Peterffy, et al.*** 162 pp. 1957. Graduate School of Business Administration, Harvard University, Boston. (T176 H26.1e)

9853 Engineering Statistics. After a thorough grounding in the necessary fundamentals of probability and distribution theory, the text turns to a discussion of the statistical techniques commonly used by engineers and physical scientists. ***Albert H. Bowker and Gerald J. Lieberman.*** 585 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, N. J. (QA276 B67e)

9854 The Human Operator as a Servo System Element. This paper considers the role of human elements in certain closed loop control systems. The human behavior description must be expressed in terms which are compatible with conventional descriptions of control system components. This compatibility is achieved by the use of a quasi-linear mathematical model for the human operator. ***Duane T. McRuer and Ezra S. Krendel.*** *Franklin Institute, Journal*, v. 267, no. 5, May 1959, p. 381-403.

9855 A Unified Approach to the Theory of Sampling Systems. Presents a new method for the analysis of sampling (or sampled-data) systems. Unlike methods currently in use, it is not necessary to assume that the sampling operations are synchronous, performed at constant rate, and representable by means of an impulse modulator. Several different types of sampling operations are considered in detail, with the analysis proceeding similarly in each case. Concludes with a brief study of the stability of sampling systems and a generalization of Floquet's theorem. ***R. E. Kalman and J. E. Bertram.*** *Franklin Institute, Journal*, v. 267, no. 5, May 1959, p. 405-436.

9856 Graduate Student Enrollment and Support in American Universities and Colleges, 1954. This survey is one in a series of studies of the money and manpower invested in scientific research by Government, industry, and nonprofit institutions. The Foundation's interest in graduate education is focused upon the natural sciences, engineeering, and certain fields of psychology and the social sciences. However, the pattern of student enrollment and stipends in these fields can best be understood in relation to that prevailing in other fields. Therefore, the survey was designed to embrace, in addition to the sciences and engineering, teacher education, humanities and arts, and many professional fields. 302 pp. 1957. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (LB2371 N21g)

9857 Information Theory and Statistics. Studies logarithmic measures of information and their application to the testing of statistical hypotheses. A unification of statistical procedures is attained by a consistent application of the concepts and properties of information theory. Applications are limited to the analysis of samples of fixed size only. ***Solomon Kullback.*** 395 pp. 1959. John Wiley & Sons, New York. (QA276 K95i)

9858 Integral Equations. Devoted entirely to non-singular linear integral equations, that is, those for which the main results of the Fredholm theory are valid. ***F. Smithies.*** 172 pp. 1958. Cambridge University Press, London. (QA431 Sm56i)

9859* Predetermined Learning Curves for Clerical Operations. This paper reports on a recent effort to establish a system for predicting learning time on routine clerical operations. Although the specific values developed in the investigation apply to certain repetitive clerical operations found in a mail order house, the basic principles could be applied to other types of similar clerical operations to predetermine learning curves with acceptable accuracy. ***M. D. Kilbridge.*** *Journal of Industrial Engineering*, v. 10, no. 3, May-June 1959, p. 203-209.

9860* On Nonlinear Differential Equations, the Maximum Operation, and Monotone Convergence. It is shown that the solutions of certain classes of nonlinear ordinary and partial differential equations may be represented in terms of the maximum operation applied to the solutions of assoicated linear equations. This, in effect, affords a new approach to the quasilinearization of nonlinear differential equations. ***Robert Kalaba.*** *Journal of Mathematics and Mechanics*, v. 8, no. 4, July 1959, p. 519-574.

9861* Invariant Imbedding and Neutron Transport Theory. IV. Generalized Transport Theory. The aim of the present paper is to extend previous results and techniques so as to include an extensive category of transport processes involving deterministic and stochastic interactions, and general geometries. Characteristic functions and probabilities, as well as expected values (fluxes), are determined. ***Richard Bellman, Robert Kalaba, and G. Milton Wing.*** *Journal of Mathematics and Mechanics*, v. 8, no. 4, July 1959, p. 575-584.

9862* The Holonomy Group. II. The Lie Group Induced by a Tensor. This paper deals with the Lie group induced by an arbitrary tensor. The first part describes the construction of the induced Lie group. The second part deals with the application to the curvature tensor. The Lie group induced by the curvature tensor is the holonomy group. The holonomy group is a very convenient tool for solving partial differential equations for covariant constant tensors. The third part introduces some basic notions and auxiliary results which will be used in the next paper of this series. ***V. Hlavatý.*** *Journal of Mathematics and Mechanics*, v. 8, no. 4, July 1959, p. 597-622.

9863 Legendre Polynomials. Prepared by the committee for the calculation of mathematical tables for the British Association for the Advancement of Science. v. A. 42 pp. 1946. Cambridge University Press, London. (QA47 B77m Over.)

9864 The Creative Engineer. I. Personality Traits. Why do some engineers frequently have "brainstorms" while others seldom even have "good ideas"? To answer this question, the author has surveyed experts on creativity across the nation. Engineering and research managers, professors, philosophers, psychologists, social scientists, consultants—all working with creative people—have provided information. A supplementary source was a 105-man panel of experts. ***Eugene Raudsepp.*** *Machine Design*, v. 31, May 28, 1959, p. 22-26.

9865 30 Attributes of the Creative Engineer. II. Intellectual Abilities. Eleven intellectual abilities of the creative engineer are discussed. ***Eugene Raudsepp.*** *Machine Design*, v. 31, June 11, 1959, p. 28-32.

9866* Material Handling in the Big 3. Management, engineering and applications approaches to handling problems are presented here in 19 articles by Ford, Chrysler, and General Motors. *Material Handling Engineering*, v. 14, no. 9, June 1959, p. 86 + 56 pages.

9867 NASA Patents Rights Debated. Question is how much proprietary interest should space agency retain over inventions performed under contract. *Missiles and Rockets*, v. 5, no. 22, June 1, 1959, p. 17.

9868 On Numerical Approximation. Proceedings of a Symposium conducted by the Mathematics Research Center, United States Army, at the University of Wisconsin, Madison, April 21-23, 1958. Approximation can be a boon under careful control, and if unwatched can be destructive. By admitting its margin of error it relaxes constraints, and so may widen a path or create one where none existed before. This symposium discusses approximation's use and misuse. ***Rudolph E. Langer, editor.*** 462 pp. 1959. University of Wisconsin Press, Madison, Wis. (QA221 L260)

9869 Some Approximate Statistical Tests. This paper enumerates and discusses a number of quick, short-cut statistical tests that are available for two common problems. The first problem is testing the difference between the means of samples drawn from two populations while the second is testing a sequence of observations to see whether there is a trend present. ***P. G. Moore.*** *Operational Research Quarterly*, v. 10, no. 1, Mar. 1959, p. 41-48.

9870 Organizations. This book is a comprehensive volume on organizations that brings together into a single framework the diverse approaches that have been taken to this subject by sociologists, followers of Taylor's scientific management, business and public administration theorists, social psychologists, and economists interested in the theory of the firm. ***James G. March and Herbert A. Simon.*** 262 pp. 1958. John Wiley & Sons, New York. (HD31 M330)

9871* Non-Abelian Ordered Groups. In this paper, the author proves some theorems about non-abelian o-groups, and gives some methods of constructing such groups. Most of the literature on o-groups is concerned with abelian o-groups, and the examples in print of non-abelian o-groups are few. ***Paul Conrad.*** *Pacific Journal of Mathematics*, v. 9, no. 1, Spring 1959, p. 25-41.

9872* Mean Play of Sums of Positional Games. In 1953 Milnor studied certain positional 2-person games and defined what he called sums of such games. He investigated the optimal strategies for these games and gave some information about them in terms of properties of the individual games. In this paper, some other strategies are considered for these sum games. They are in general not optimal. However, the difference between what a player gets when playing one of them instead of playing an optimal strategy can be estimated. For the sum of n copies of the same game this difference is bounded for all n. Hence, in mean this difference is small for large n. ***Olof Hanner.*** *Pacific Journal of Mathematics*, v. 9, no. 1, Spring 1959, p. 81-99.

9873* Fredholm Eigen Values of Multiply-Connected Domains. *M. Schiffer.* *Pacific Journal of Mathematics*, v. 9, no. 1, Spring 1959, p. 211-269.

9874* Homogeneous Stochastic Processes. The form of a stationary translation-invariant Markov process on the real line has been known for some time, and these processes have been variously characterized as infinitely divisible or infinitely decomposable. The purpose of this paper is to study a natural generalization of these processes on a homogeneous space (X,G). ***John W. Woll, Jr.*** *Pacific Journal of Mathematics*, v. 9, no. 1, Spring 1959, p. 293-325.

9875 A Philosopher Looks at Science. Gives a unified picture of the nature of science by exploring and clarifying fundamental problems under such headings as scientific method, credibility and induction, concepts of science, measurement, and scientific explanations. ***John G. Kemeny.*** 273 pp. 1959. D. Van Nostrand Co., Inc., Princeton, N. J. (Q175 K31p)

9876 Positivism, a Study in Human Understanding. The term "Positivism" has been taken over from Auguste Comte's *Philosophie Positive*, which is rooted in conceptions one can trace back to antiquity. It is this development which provides the basis for all comments on the various problems presented in this text. ***Richard von Mises.*** 404 pp. 1956. George Braziller, Inc., New York. (Q175 M68ktr)

9877 Probability Theory for Statistical Methods. This treatise sets out to state and prove in elementary mathematical language those propositions and theorems of the calculus of probability which have been found useful for students of elementary statistics. ***F. N. David.*** 230 pp. 1951. Cambridge University Press, London. (QA273 D28p)

9878 Proceedings Seventh Annual Conference on Industrial Applications of X-Ray Analysis, August 13-15, 1958. Annealing texture in a rolled and artificially nucleated Al single crystal; substructure characteristics of fine-grained metals and alloys disclosed by X-ray microscopy and diffraction analysis; the mechanism of recrystallization of Al; X-ray observations; spectra for X-ray microscopy; crystallography; instrumentation for X-ray diffraction; microstructure, mass and chemical analysis; fluorescent X-ray analysis; determination of U in flotation concentrates and in leach liquors by X-ray fluorescence; quantitative analysis of trace amounts of Sn in steel; techniques for X-ray diffraction studies of radioactive materials; cladding thickness of fuel elements; determination of Ca in wolframite concentrates. ***William M. Mueller, editor.*** 359 pp. 1959. Denver Research Institute, University of Denver, Colorado. (QC481 C76p)

9879 Does America Have a Design Heritage? Designers, engineers, and marketers debate the factors that should determine the appearance and the engineering of American manufactured products. All talk of the presence or lack of traditions of good design in America's history and culture. *Product Engineering* asked a group of American and foreign artists, designers, engineers, and architects to give their opinions. Here they are. ***Henry Dreyfuss.*** *Product Engineering*, v. 30, no. 20, May 18, 1959, p. 36-43.